

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
KUMASI COLLEGE OF ARCHITECTURE AND PLANNING
DEPARTMENT OF BUILDING TECHNOLOGY**

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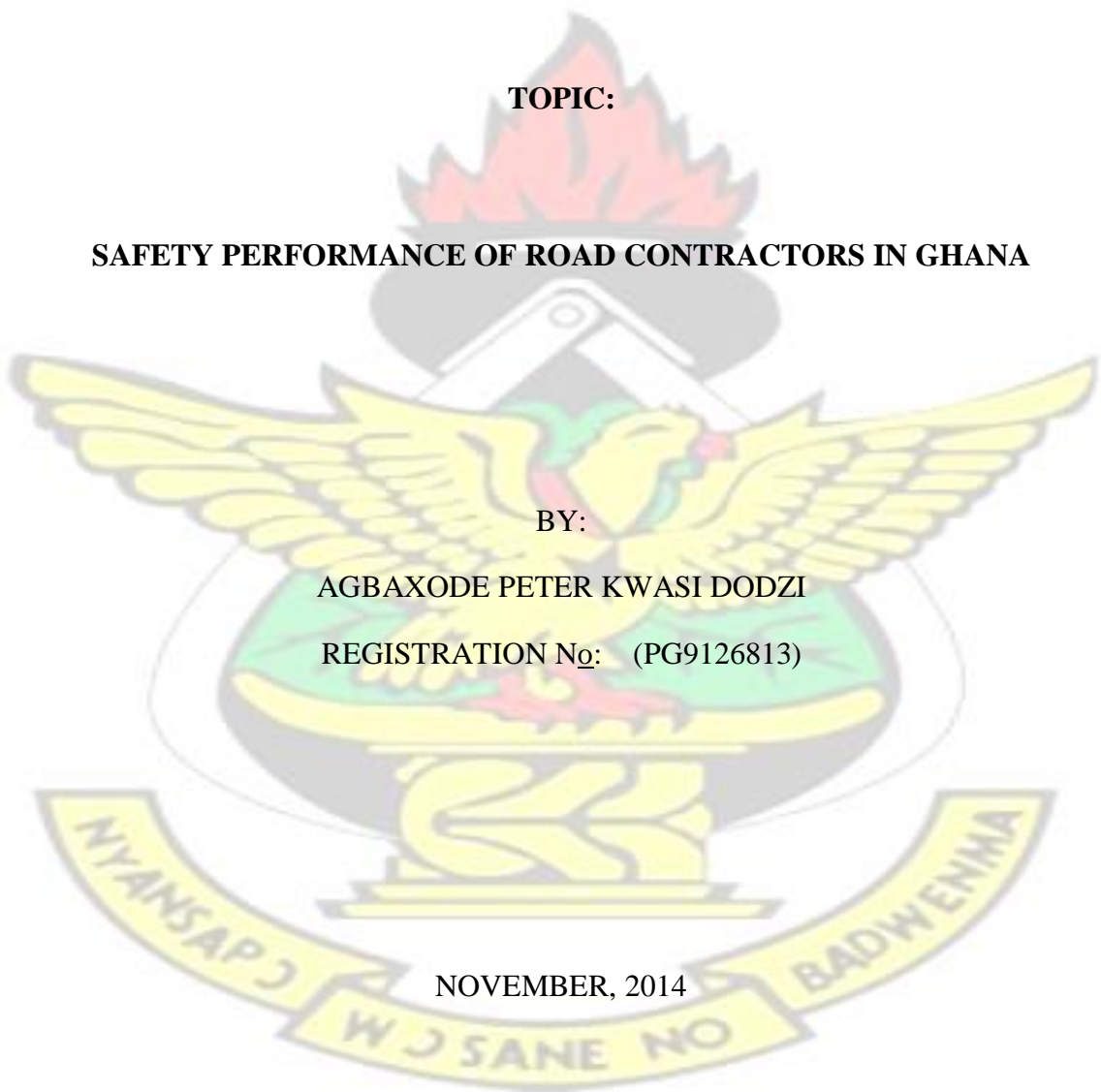
SAFETY PERFORMANCE OF ROAD CONTRACTORS IN GHANA

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SAFETY PERFORMANCE OF ROAD CONTRACTORS IN GHANA

By

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degree of

MASTER OF SCIENCE

Construction Management

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DECLARATION

I hereby declare that this submission is my own work towards the Master of Science Degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other Degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

Occupational safety practice is of utmost importance in the construction industry because the industry is widely regarded as an accident prone one. In many developed countries, there are statutory instruments and legislative frameworks that govern construction operations on site. In the year 2000, the Labour Department reported that the construction industry in Ghana accounted for the highest rate of occupational deaths in comparison to other industrial sectors. There are a lot of researches on occupational health and safety but attention is not drawn to the performance of the road construction industry in terms of safety practices in Ghana. The overall purpose of this study was to empirically evaluate the safety performance of road construction companies in Ghana. In order to collect relevant data for the study, the entire work was clustered into a questionnaire survey and case study. Selected road contractors were evaluated on safety performance using the adapted evaluation tool. The research was conducted in the Greater Accra region of Ghana. The population comprised of all categories of road construction companies and a sample size of 64 road construction companies was selected. The evaluation results indicate that the road construction sector on the average scored forty one percent (41%) for safety performance as measured on the various sites. It was concluded that the most important group factors affecting the safety performance of road contractors were found to be 1) Provision of safety and welfare facilities, 2) Safety Responsibility of management and individuals, 3) Safety Programs and Work Practices,

4) Incident Reporting and Investigation and 5) Management Commitment. It was recommended that since the level of safety performance by road construction companies in Ghana is low there is therefore the need to improve safety performance in the road construction industry. The laws on safety are too scattered in a lot of documents hence Government and all regulatory bodies should come out with a well compiled and concise document, regulations and laws on Safety practices for the road construction industry to regulate the activities of the industry players.

KEY WORDS: Occupational safety; Performance; Evaluation; Construction Companies; Ghana

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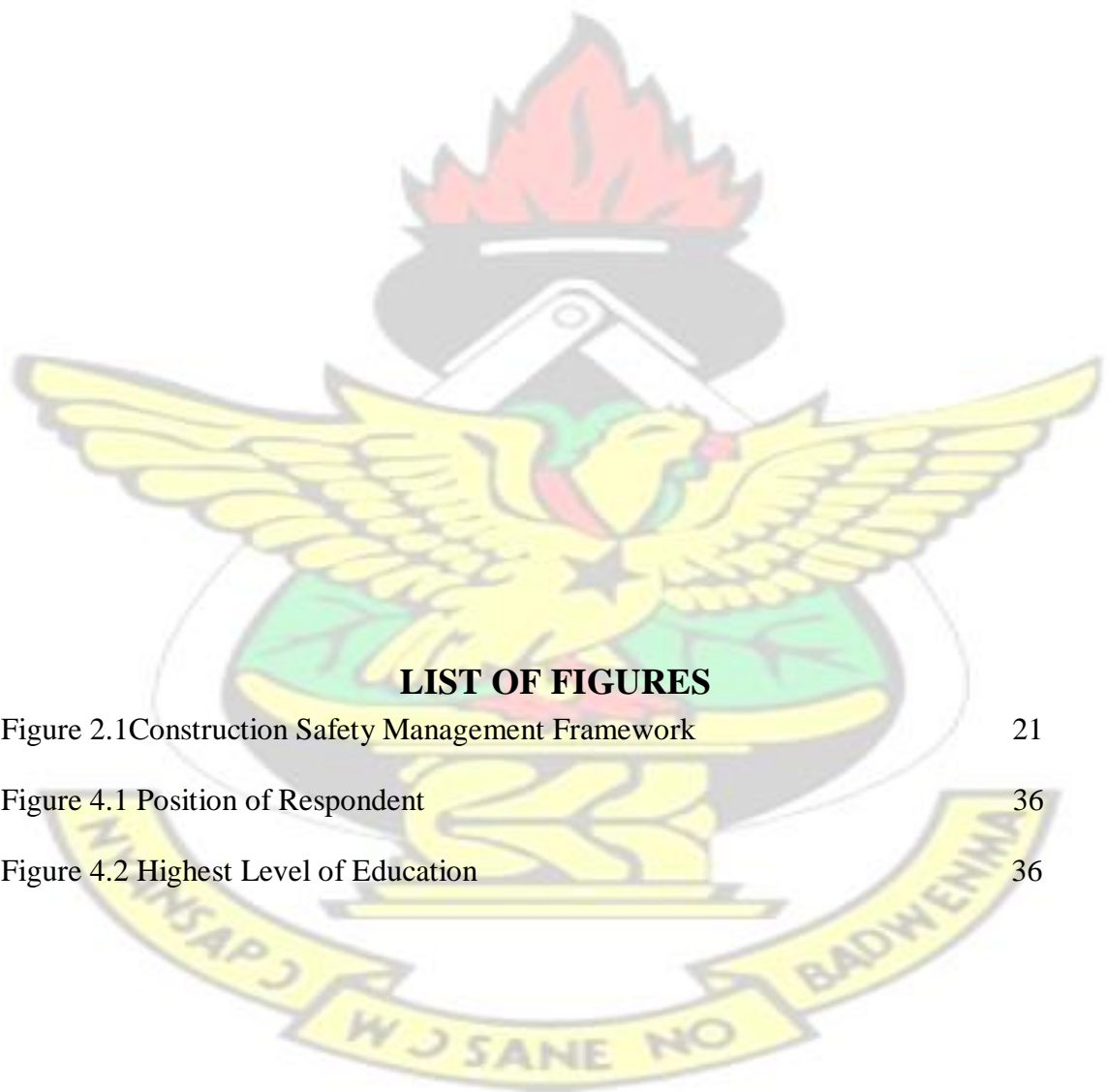
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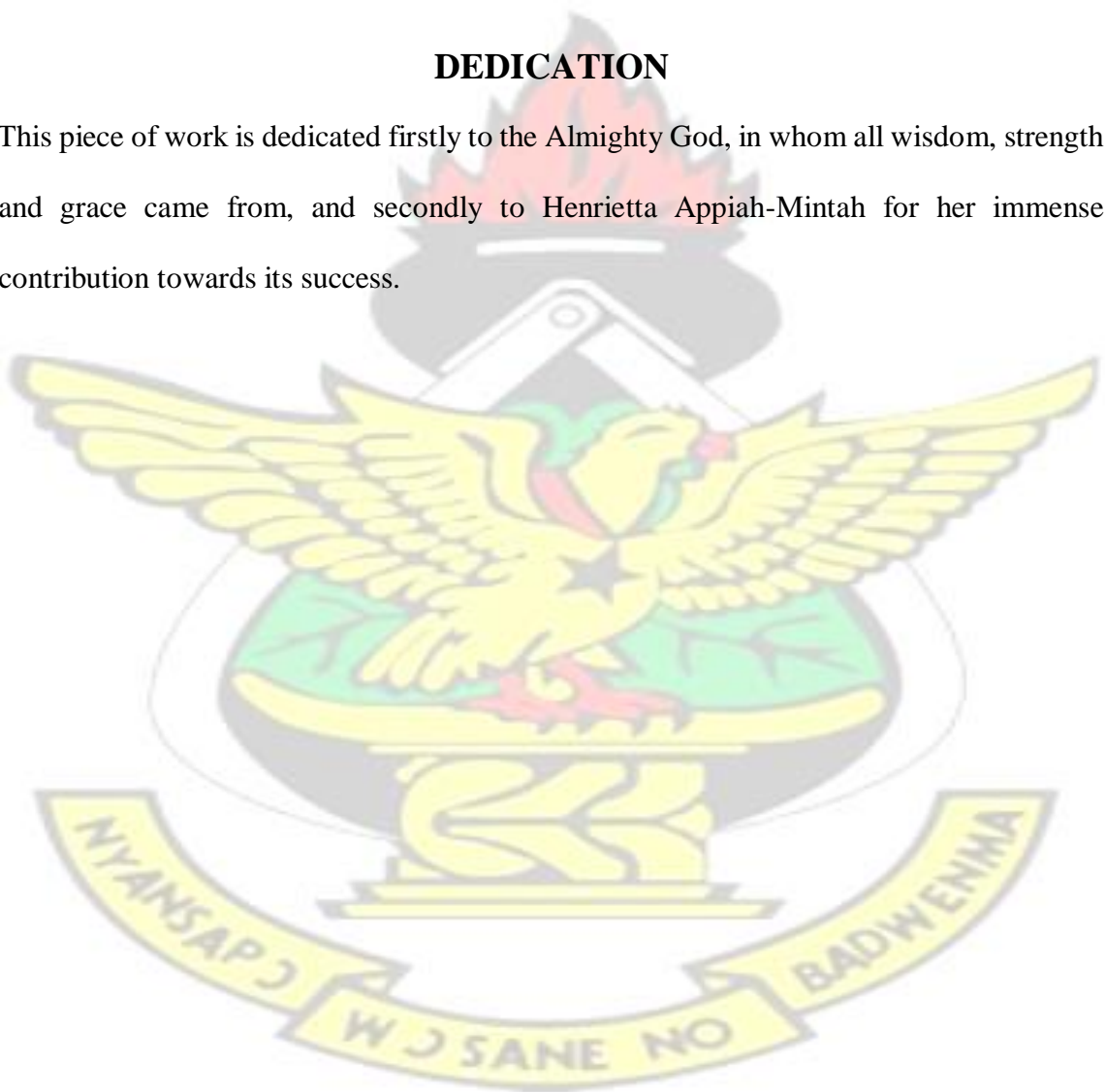
Last but not the least, thanks to all who have made this dissertation possible.

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DEDICATION

This piece of work is dedicated firstly to the Almighty God, in whom all wisdom, strength and grace came from, and secondly to Henrietta Appiah-Mintah for her immense contribution towards its success.



CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Occupational safety practice is of utmost importance in the construction industry. Construction is widely regarded as an accident prone industry and it is said to be a sector with a lot of accidents and injuries taking place always (Lingard & Rowlinson, 2005). The reasons construction is risky and prone to safety risks are; 1) because of the physical environment of the work, 2) nature of the construction work operations, 3) construction methods, 4) construction materials, 5) heavy equipment used, and 6) physical properties of the construction project itself (Menzel & Gutierrez, 2010).

Safety regulations are made for the maintenance and assurance of safety of not only the worker (employee) but also the general public and the employer. In Ghana, it is covered under the Labour Act 2003 (Act 651) and the health and safety at work Act, Act 1974 in the United Kingdom (UK) and other statutory regulations to regulate work activities with regards to safety.

In the year 2000, the Labour Department reported that the construction industry in Ghana accounted for the highest rate of occupational deaths in comparison to other industrial sectors. According to the Labour Department (2000) report, 56 out of a total of 902 occupational accidents that occurred in construction in that year were fatal.

Construction health and safety should be of primary concern to employers, employees, governments and project participants (Kheni, 2008). Thus the main parties responsible for construction safety are the client, main contractor, regulatory agencies and employees.

Government regulatory agencies should enact regulations to help ensure that a construction project is safe to build, safe to use, and safe to maintain and delivers good value. Good safety planning also helps to ensure that a project is well managed and that unexpected costs and problems are minimized. Clients or employers should ensure that they provide safe working environment for their employees. Employees should also be made aware of their health and safety responsibilities.

1.2 PROBLEM STATEMENT

Construction is a high hazard industry that comprises a wide range of activities involving construction, alteration, and /or repair. Construction workers engage in many activities that may expose them to serious hazards.

According to the Labour Act (Act 651), it is the employer's duty to ensure that there is a safe and healthy environment to carry out work and all works must be carried out in a safe manner as possible. A typical construction site may require workers to wear a hard hat, overalls, safety footwear, gloves, eye protection and high visibility vest. These must be provided to all employees. There are safety problems on almost all construction sites. It is therefore required that all personnel who are employed to carry out construction work on site must be trained, competent and fit to do the job safely and without putting their own or others' safety at risk (Labour Act 2003, Act 651).

A study by Kheni (2008) on health and safety practices in Ghana revealed that there is lack of skilled human resources, inadequate government support for regulatory institutions and inefficiency in institutional frameworks responsible for health and safety standards.

There are a lot of research on occupational health and safety but attention is not drawn to the performance of the road construction industry in terms of safety practices in Ghana. The industry is known to be a sector that also employs a lot of workers. However information on its safety performance is scanty hence this study.

1.3 AIM AND OBJECTIVES

The overall purpose of this study is to empirically evaluate the safety performance of road construction companies in Ghana.

By way of specific objectives, this study seeks:

1. To identify the factors that significantly influence safety performance of road contractors.
2. To adopt and adapt a standardized tool for evaluating the safety performance of road construction companies.
3. To evaluate the safety performance of selected road construction companies in Ghana using the standardized tool.

1.4 RESEARCH QUESTIONS

1. What is the level of safety performance of road construction companies in Ghana?
2. Do road construction companies in Ghana adhere to safety regulations?

1.5 SIGNIFICANCE OF THE STUDY

This study is undertaken to establish the need for evaluating the safety performance of road construction companies in order to:

- Provide data on the safety performance of road construction companies in Ghana.

The study brings to light how the road construction industry in Ghana is performing and adhering to safety practices.

- Provide data or information that can be used by professionals and other agencies.

It serves as a reference point for people who may want to carry out similar studies in other jurisdictions.

1.6 SCOPE OF THE STUDY

This study was done on road construction companies only precisely those based in the Greater Accra region.

The study only focused on safety performance of the various road construction companies without any evaluation of health related issues. Even though occupational health and safety in most instances are lumped together in most research works and lies contiguous to each other, the researcher however did not include health in this study.

1.7 ORGANIZATION OF THE REPORT

This research report is organised into Five appropriate chapters.

Chapter One is the Introductory part stating the aim and objectives, problems and significance of the study.

Chapter Two involves Literature review on the topic.

Chapter Three outlines the methodology. It includes the research design.

Chapter Four is Data analysis and Discussion.

The Fifth Chapter brings to light the Findings, Conclusion and Recommendations.

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CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Safety is a concern to all in the construction industry from top management to the least worker on site. The ever-increasing cost of medical treatment and the potential for lawsuits can lead to higher insurance premiums, which in turn have a negative impact on a company's profit (Abdul-Rashid, Bassioni & Bawazeer, 2007).

The construction industry is considered one of the most hazardous industries in the world. It is a fact that accidents and injuries can bring great losses to individuals, organizations and societies or the public at large. It has been clearly stated that safety is not a luxury but a necessity, and can prevent unnecessary loss of property, injury, or death. In some countries, a contractor's safety performance record can be considered in contractor

qualification. Moreover, the suffering as a result of an accident both to injured parties and their families cannot be measured in economic terms, even if the injured parties have been adequately compensated by insurance (Abdul-Rashid et al., 2007).

2.2 SAFETY

The Oxford advanced learners dictionary (2010) defines safety as the state of being safe and protected from danger or harm.

Safety according to the Wikipedia free encyclopedia is the state of being "safe", the condition of being protected against physical, social, spiritual, financial, political, emotional, occupational, psychological, educational or other types or consequences of failure, damage, error, accidents, harm or any other event which could be considered non-desirable.

Safety can also be defined as the control of recognized hazards to achieve an acceptable level of risk. This can take the form of being protected from the event or from exposure to something that causes health or economic losses. It can include protection of people or of possessions.

2.2.1 Safety in Construction

According to Laryea and Mensah (2010), construction is widely regarded as an accident prone industry. The reasons why construction is risky and prone to health and safety risks are because of the physical environment of the work, nature of the construction work operations, construction methods, construction materials, heavy equipment used, and physical properties of the construction project itself.

The main health and safety site requirements in construction relate to tidy sites and decent welfare, falls from height, manual handling, and transport on site. Site operatives are normally required to plan and organize their operations, ensure that they are trained and competent and know the special risks of their trade and raise problems with their site supervisor or safety representative (HSE, 2009).

The main personal protective equipment (PPE) in construction (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects him against one or more risks to his safety should always be used. A typical construction site may require workers to be in personal protective equipment. These must be provided to all employees. Construction safety should be of primary concern to employers, employees, governments and project participants. Main Contractors must check that all subcontractors are conforming by providing PPE for all their employees free of charge. Employees should be made aware of their responsibility to wear the PPE appropriately, take care of equipment and report any defects (Laryea & Mensah, 2010).

According to Laryea and Mensah (2010) there are safety problems on almost all construction sites which relate to reporting accidents, employing and subcontracting. All personnel who are employed to carry out construction work on site must be trained, competent and fit to do the job safely and without putting their own or others' safety at risk; properly supervised and given clear instructions; have access to washing and toilet facilities; have the right tools, equipment, plant and protective clothing; educated about safety issues.

2.2.2 Road Construction Safety

Workers in highway work zones are exposed to a variety of hazards and face risk of injury and death from construction equipment as well as passing motor vehicles. Workers on foot are exposed to passing traffic, often at high speeds, while workers who operate construction vehicles are at risk of injury due to overturn, collision, or being caught in running equipment. Regardless of the task assigned, all construction workers work in conditions of poor lighting, poor visibility, inclement weather, congested work areas, high volume traffic and speeds. In 2011, there were a total of 119 fatal occupation fatalities in road construction sites in USA. In 2010 there were 37,476 injuries in work zones, about 20,000 of those injuries are construction workers. Because they are so complicated, slight lapses in safety or awareness that might lead to mild accidents in other construction sites can be deadly for roadway construction workers. Causes of road worksite injuries include being struck by objects, trucks or mobile equipment (35%), falls or slips (20%), overexertion (15%), transportation incidents (12%), and exposure to harmful substances or environments (5%). Causes of fatalities include getting hit by trucks (58%), mobile machinery (22%), and automobiles (13%); retrieved from (www.workzonesafety.org).

2.2.3 Efforts to Improve Safety

According to graphic online, a draft national occupational safety and health policy designed to prevent industrial accidents and minimize the incidence of diseases has been developed by the Ministry of Employment and Social Welfare to replace the existing policy which has become outmoded in many respects. Additionally, the ministry is receiving support from the International Labour Organization (ILO) to develop legislation on occupational safety and health as a step towards a comprehensive review of the

Factories, Offices and Shops Act, 1970 (Act 328) to reflect the technological advancement in factory inspection. It was reported that the ILO is assisting the ministry to compile the occupational safety and health profile for the country.

2.3 HAZARDS TO CONSTRUCTION WORKERS

According to the Occupational Safety and Health Administration (OSHA), the leading safety hazards on site are falls from height, motor vehicle crashes, excavation accidents, electrocution, machines, and being struck by falling objects. Falls from heights are the leading cause of injury in the construction industry. In the OSHA Handbook, fall protection is needed in areas and activities that include, but are not limited to: ramps, runways, and other walkways; excavations; hoist areas; holes; formwork; leading edge work; unprotected sides and edges; overhand bricklaying and related work; roofing; precast erection; wall openings; residential construction; and other walking or working surfaces (OSHA Handbook).

2.3.1 Hazards to Non-Workers

Many construction sites cannot completely exclude non-workers. Road construction sites must often allow traffic to pass through. This places non-workers at some degree of risk. Road construction sites are blocked-off and traffic is redirected. The sites and vehicles are protected by signs and barricades. However, sometimes even these signs and barricades when not properly designed and placed can be a hazard to vehicular traffic. The majority of deaths in construction are caused by hazards relating to construction activity. However, many deaths are also caused by non- construction activities. In the USA there is a safety law relating to non- construction activities.

2.4 REGULATIONS AND LAWS ON SAFETY

There are statutory instruments and legislative frameworks in many developed countries to govern construction operations on site and help in minimizing health and safety hazards for example, The Construction (Design and Management) Regulations 2007

(S.I. 2007/No. 320) Regulations on Health and Safety in the UK construction industry.

The Health and Safety at work Act (Act 1974) in the United Kingdom to regulate work activities with regards to safety. In the United States, the Occupational Safety and Health Administration (OSHA) sets and enforces standards concerning workplace safety and health.

There are other regulations that govern safe work practices in most developed countries which is not the case in Ghana. Most of these regulations or laws are scattered and not put together as a working document to check safety practices at the various workplaces. However, the characteristics of construction in developing countries are not the same as characteristics of construction in developed countries.

2.4.1 Current Situation of Laws or Regulations on Safety in Ghana

There are currently two major edicts that have provided guidance in the provision of occupational safety services, practice and management in Ghana. These include the Factories, Offices and Shops Act 1970, Act 328 and the Mining Regulations 1970 LI 665, but these have only driven the mining and the labour sectors and are therefore very limited in scope, given the multifaceted distribution of industrial operations that we have in Ghana.

There is the Workmen's Compensation Law 1987 (PNDC Law 187) which relates to compensation for personal injuries caused by accidents at work and hence, indirectly impacts on monitoring worker and workplace safety.

There are other statutes which indirectly impact on Occupational Safety and these include the Environmental Protection Agency Act 490 1994, the Ghana Health Service and Teaching Hospital Act 526, 1999 and the National Road Safety Commission Act 567(1999).

Though, Ghana is among the 183 member countries of ILO, which requires, as per the ILO convention number 155 1981, that member countries formulate, implement and periodically review a coherent policy on occupational safety and health and work environment, Ghana has not yet rectified this convention and the nation has no established authority dedicated to Occupational Safety and Health to guide and facilitate the implementation of the "Action at the National Level".

However, the Labour Act 2003, Act 651, Part XV, sections 118 to 120 apparently directs employers and employees in their roles and responsibilities in managing Occupational Health, Safety and Environment in the nation, but is not specific about whom to report accidents to. Currently, accidents that occur in factories are expected to be reported to the Department of Factory Inspectorate but Companies hardly report such events to the inspectorate for investigation and correction.

According to the Labour Act, 2003, (Act 651) Part III – Protection of Employment; Duties of employers, it is the duty of an employer to take all practicable steps to ensure that the worker is free from risk of personal injury or damage to his or her health during and in the course of the worker's employment or while lawfully on the employer's premises.

It is also the Rights of a worker to work under satisfactory, safe and healthy conditions as provided for by the Act. However, it is the duty of a worker to take all reasonable care for the safety and health of fellow workers.

2.4.1.1 The Labour Act 2003, Act 651(General Health and Safety Conditions)

It is the duty of an employer to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions

An employer shall provide and maintain the workplace, plant and system of work that are safe and without risk to health; provide the necessary information, instructions, training and supervision; supply and maintain at no cost to the worker adequate safety appliances, welfare facilities, suitable fire-fighting equipment, personal protective equipment, and instruct the workers in the use of the appliances or equipment;

It is the obligation of every worker to use the safety appliances and personal protective equipment provided by the employer in compliance with the employer's instructions.

The Minister may by legislative instrument make Regulations providing for specific measures to be taken by employers to safeguard the health and safety of workers employed by them.

The nation has seen some positive "Safety practice infection" among some of our Ghanaian companies due to the influx of some multinational companies into the country, given their corporate expectations with specific requirements in Occupational Safety practices. This stems from their requirements for the contractors, and subcontractors, some of whom are Ghanaian, to follow their Health and Safety standards. Currently, the Oil and Gas sector has introduced their side of approach to managing health and safety. This is

purely based on risks and is definitely an improvement on what is existing. In as much as this is a good effort and helps the Ghanaian to know there is more to Occupational Safety, it tends to confuse the Ghanaian the more with regard to which standard to follow in the nation, and what is required to make employees and employers accountable.

2.5 PERFORMANCE

Performance is the accomplishment of a given task measured against preset known standards of accuracy, completeness, cost, and speed. In a contract, performance is deemed to be the fulfillment of an obligation, in a manner that releases the performer from all liabilities under the contract (www.businessdictionary.com).

2.5.1 Safety Performance

The rate of industrialization in Ghana is on the ascendancy and this has led to larger percentage of the Ghanaian workforce being exposed to workplace physical, chemical, biological and psychological stressors, but the nation does not have a system of anticipating, monitoring, evaluating, controlling and preventing such exposures to the workforce.

Employers in Ghana are required by the Ghana Labour Act 2003, Act 651 to ensure their employees are not exposed to conditions that would lead them to work related injuries. Employees are also required to exhibit their duty of care in ensuring that they work as per the employers' standard operating procedures which must incorporate Safety requirements. However, most Ghanaian workers and the employers are not aware of their safety responsibilities and obligations.

2.6 EVALUATION

Evaluation is a systematic determination of a subject's merit, worth and significance, using criteria governed by a set of standards. It can assist an organization, program, project or any other intervention or initiative to assess any aim, realisable concept or proposal, or any alternative, to help in decision-making; or to ascertain the degree of achievement or value in regard to the aim and objectives and results of any such action that has been completed. The primary purpose of evaluation, in addition to gaining insight into prior or existing initiatives, is to enable reflection and assist in the identification of future change (www.businessdictionary.com).

Evaluation can be formative which can take place during the development of a concept or proposal, project or organization, with the intention of improving the value or effectiveness of the proposal, project, or organization. It can also be assumptive, drawing lessons from a completed action or project or an organization at a later point in time or circumstance (www.businessdictionary.com).

Evaluation is inherently a theoretically informed approach (whether explicitly or not), and consequently any particular definition of evaluation would have to be tailored to its context - the theory, needs, purpose, and methodology of the evaluation process itself.

Having said this, evaluation has been defined as a systematic, rigorous, and meticulous application of scientific methods to assess the design, implementation, improvement, or outcomes of a program. It is a resource-intensive process, frequently requiring resources, such as, evaluate expertise, labor, time, and a sizable budget.

2.7 FACTORS THAT INFLUENCE CONSTRUCTION SAFETY PERFORMANCE

Many research efforts on construction safety have focused on the critical factors that affect construction safety. These efforts identified a variety of ways that supervisors and managers of construction companies can impact on the safety performance of a construction project. Most companies follow established safety guidelines and policies that meet Occupational Health and Safety guidelines. However, most Safety Management Assessment Framework incidents and injuries at construction sites are a direct result of not adhering to the established safety procedures; hence, construction safety performance can be affected by several factors (Priyadarshani, Gayani & Sajani, 2013).

In general, accidents at work occur either due to lack of knowledge or training, lack of supervision, or lack of means to carry out the task safely, or alternatively, due to an error of judgment, carelessness, apathy or downright reckless. In addition to these factors, the short term and transitory nature of the construction industry, the lack of a controlled working environment and the complexity and diversity of the size of organizations, all have an effect on safety performance within the industry. In construction, it is suggested that 'unsafe behaviour' is the most significant factor in the cause of site accidents and therefore provides evidence of a poor safety culture (Sawacha et al., 1999).

According to Sawacha et al. (1999), safety performance is linked with the following factors;

- i. Historical, ii.
Economical,
- iii.
Psychologic

al, iv.

Technical,

v. Procedural, vi.

Organizational vii.

Environmental issues

The Historical factor is assessed by the background and characteristics of the individual, such as age and experience.

The Economic factor is determined by the monetary values which are associated with safety such as, hazard pay.

The Psychological factor is assessed by the safety behavior of fellow workers on site including supervisors.

The Technical and procedural factors are assessed by the provision of training and handling of safety equipment on site.

The Organizational and environmental factors are assessed by the type of policy that the management adapts to site safety (Priyadarshani et al, 2013).

According to Abdul-Rashid (2007), many authors have discussed the factors affecting safety performance in international literature.

Table 2.1 summarizes the factors affecting the safety performance identified in each literature (Abdul-Rashid, 2007).

Table 2.1: Factors affecting Safety Performance in International Literature

Literature	Factors affecting Safety Performance
------------	--------------------------------------

Jaselskis, et al. (1996)	<ul style="list-style-type: none"> ➤ Upper management support. ➤ Time devoted to safety issues for the company safety coordinator. ➤ Number of informal safety inspections made by the company safety coordinator. ➤ Meetings with the field safety representatives and craft workers. ➤ Length and detail of the company safety program. ➤ Safety training for new foremen and safety coordinators. ➤ Specialty contractor safety management. ➤ Company safety expenditures. ➤ Increased project manager experience level. ➤ More supportive upper management attitude towards safety. ➤ Reduced project team turnover (team stability). ➤ Increased time devoted to safety for the project safety representative. ➤ More formal meetings with supervisors and specialty contractors. ➤ More informal safety meetings with supervisors. ➤ A greater number of informal site safety inspections. ➤ Increased budget allocation to safety awards.
Sawacha, et al. (1999)	<ul style="list-style-type: none"> ➤ Management talks on safety. ➤ Provision of safety booklets. ➤ Provision of safety equipment. ➤ Providing safety environment. ➤ Appointing a trained safety representative on site.
Hinze and Gambatese (2003)	<ul style="list-style-type: none"> ➤ Minimizing worker turnover. ➤ Implementing employee drug testing with various factors initiating the testing. ➤ Training with the assistance of contractor associations. ➤ Growth in company size.
Fang, et al. (2004a)	<ul style="list-style-type: none"> ➤ Frequency of a crew's receiving safety inspection. ➤ Frequency of a foreman's presence in safety meeting. ➤ Frequency of a foreman's reporting safety related matters to manager. ➤ Frequency of a foreman's announcing safety related matters to workers. ➤ Frequency of a foreman's correcting workers' unsafe actions. ➤ Frequency of a worker's smoking on the site. ➤ Frequency of a worker's breaking safety regulations. ➤ Hours of safety education per year a worker receives. ➤ Frequency of a worker's partners reminding him of personal safety. ➤ Frequency of a crew's receiving notices of hazard removal. ➤ Frequency of a crew's breaking safety regulations. ➤

Table 2.1Continued

Literature	Factors affecting Safety Performance
	<ul style="list-style-type: none"> ➤ Frequency of a crew's suffering safety penalty. ➤ Frequency of a project manager's presence in safety meeting ➤ ➤ Frequency of a project manager's hearing safety reports. ➤ Frequency of a project manager's discussing safety matters with subcontractors. ➤ Days of safety education per year a safety officer receives. ➤ Hours of safety education per year a foreman receives. ➤ Frequency of a foreman's reminding new workers of safety regulations. ➤ Ratio of workers whose occupational experience is less than 1 year to total workers on site.
Fang, et al. (2004b)	<ul style="list-style-type: none"> ➤ Quantity of safety supervisors. ➤ Involvement of contractor top management. ➤ Authority of safety supervisor. ➤ Authority of foremen. ➤ Size of the crew. ➤ Safety investment. ➤ Worker compensation insurance. ➤ Safety investment on personal protective equipment. ➤ Factors related to the relationship between management and labor on site.
Tam, et al. (2004)	<ul style="list-style-type: none"> ➤ Poor safety awareness of top management. ➤ Lack of training. ➤ Poor safety awareness of project managers. ➤ Reluctance to input resources to safety. ➤ Reckless operations.
Ng, et al.(2005)	<ul style="list-style-type: none"> ➤ Implementation of safety management system in accordance with legislation. ➤ Compliance with occupational safety and health legislation, codes and standards. ➤ Definition of safety responsibility. ➤ Development of safety policy. ➤ Provision of safe working environment. ➤ Development of emergency plan and procedures. ➤ Development of safety committee. ➤ Definition of safety responsibility to all site personnel.

Table 2.1Continued

Literature	Factors affecting Safety Performance
Fung, et al. (2005)	<ul style="list-style-type: none"> ➤ Effective accident reporting. ➤ High line management commitment. ➤ Active supervisor's role. ➤ Active personal role.
Teo, et al. (2005)	<ul style="list-style-type: none"> ➤ Understanding and implementation of safety management system. ➤ Understanding and participation in occupational health and safety management system. ➤ Understanding and implementation of permit-to-work system. ➤ Quality of subcontractors. ➤ Understanding and implementation of safety procedures. ➤ Carrying out work in a safe manner. ➤ Carrying out work in a professional manner. ➤ Type and method of construction. ➤ Management's attitude towards safety. ➤ Supervisors and worker's attitude towards safety. ➤ Contextual characteristics of workers. ➤ Monetary incentives. ➤ Non-monetary incentives. ➤ Disciplinary action.

Source: (Abdul-Rashid, 2007)

2.7.1 Prioritizing the Factors that Influences Safety Performance on Construction Sites

A study conducted by Chia-Kuang and Yusmin (2012), in an attempt to prioritize the factors that influences safety performance on construction sites pinpoint six (6) major factors upon thorough review of literature. The factors include:

- Management,
- Incentives,
- Process,
- Policy,
- Technical, and
- Incentives related factors

These factors are relevant to the governance of safety on construction sites per-se distinctively.

An effective safety management framework was developed by Priyadarshani et al. (2013) based on the above studies, and the factors affecting construction safety management are illustrated in the framework as shown in figure 2.1 below.

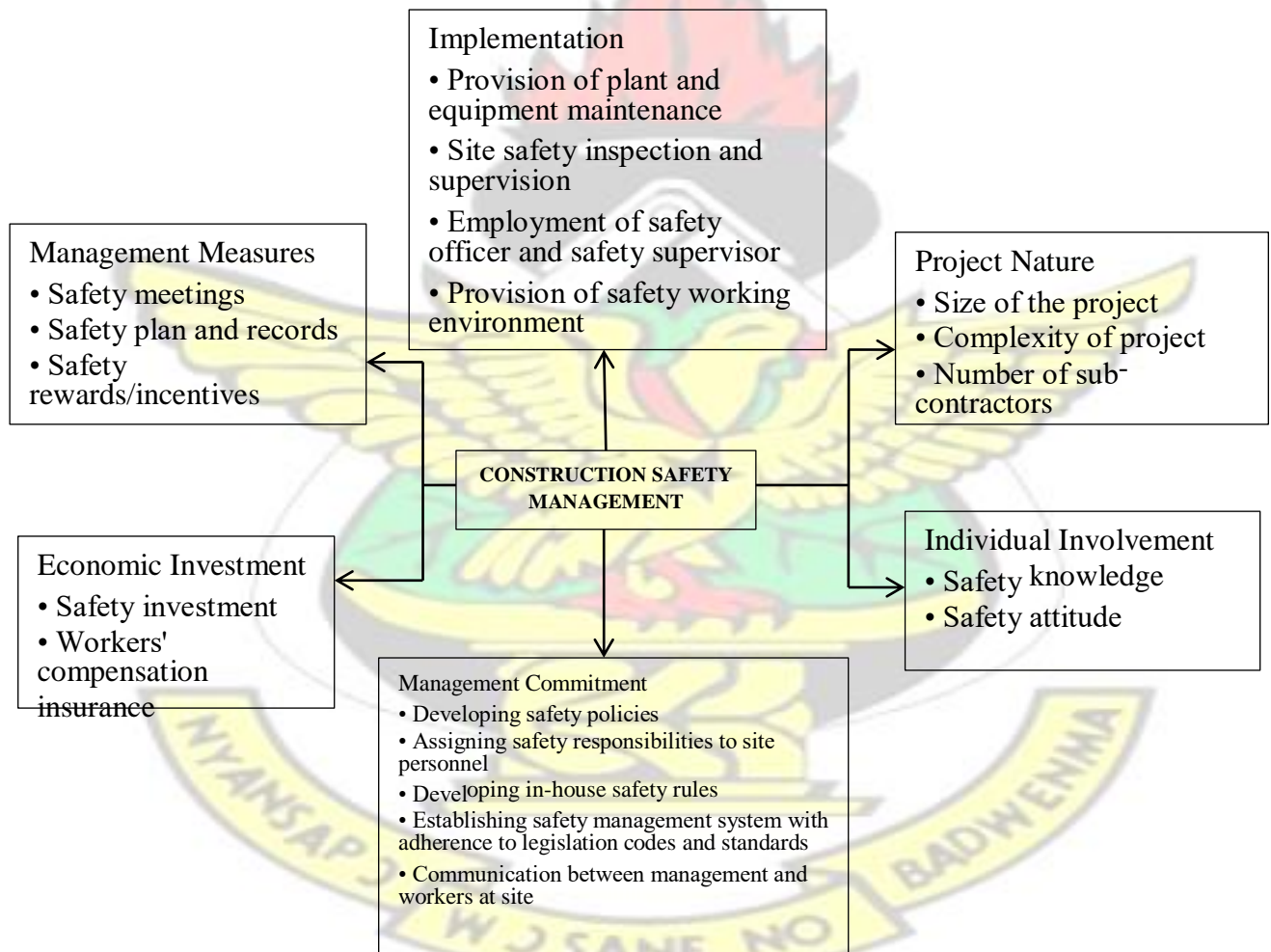


Figure 2.1 Construction Safety Management Framework

Source: (Priyadarshani et al., 2013).

2.8 TOOLS FOR EVALUATING SAFETY PERFORMANCE

2.8.1 Previous Research on Safety Performance Evaluation Methods

A research conducted by Ng et al. (2005) on a framework for evaluating the safety performance of construction contractors reveals the following methods of evaluating safety Performance of contractors:

1) **Accident Rate:**

The use of accident rates (AR) is superior to other indices, measuring performance simply by the number of accidents has long been regarded as an unsound basis for comparison (Tam and Fung 1998, cited in Ng et al.

2005). Contractor's diligently reporting and investigating accidents are disadvantaged in comparison with less scrupulous contractors who under-report accident occurrence (Rowlinson, cited in Ng et al. 2005). It is unlikely, therefore, that contractors would be sufficiently motivated to report the number of accidents accurately.

2) **Incidence Rate:**

The incident rate (IR) can be computed according to the number of lost time cases (lost time IR), number of days lost for all lost time cases (severity rate or lost workday rate), and number of fatalities, injuries and illnesses with or without lost workdays (recordable IR). However, IR is not an objective means for evaluating safety performance, as different definitions may be adopted during the computation process (Jaselskis et. al, 1996). Similarly to the AR, the accuracy of IR depends on how honest a contractor is in revealing the reportable accidents,

illnesses, fatalities and injuries. Also, as some construction workers are not aware of their OHS rights, they may not be in a position to claim for compensations.

3) **Experience Modification Rating:**

The experience modification rating (EMR) reflects the cost companies have to pay for workers' compensation insurance. It is essentially the ratio between actual claims filed and expected claims for a particular type of construction. However, since the EMR formulae are relatively complex and different versions of calculation exist in practice (Everett & Thompson, cited in Ng et al. 2005), EMR is not an appropriate measure of safety performance for all types of companies (Hinze et al, cited in Ng et al. 2005). In addition, as the EMR is based on running average results over several years, this method cannot truly reflect the current safety performance of companies (Levitt & Samelson, cited in Ng et al. 2005).

4) **Score Card:**

The score card (SC) system as introduced by the HK Government consists of six key aspects: the

- Provision and maintenance of plant;
 - Provision and maintenance of the working environment;
 - Provision of information, instruction and training;
 - Provision and implementation of safety systems of work;
 - Employment of safety officers/supervisors; and ➤ Site accident records
- (Works Bureau, 2000).

Weight is allocated to each factor to reflect its importance. An assessor is required to assign a rate to each factor. However, one major weakness of the existing SC system is

that it only takes into account the contractor's safety performance at a project level without considering organisation-related SPE factors. In addition, there is a lack of solid foundation as to how the weightings are established (Ng et al, 2005).

2.8.2 Overcoming the Limitations Associated with Existing Methods of Evaluating Construction Safety Performance

To overcome the limitations associated with existing methods, other measures of safety performance can be implemented (El-Mashaleh et. al, cited in Priyadarshani et al, 2013). There are several methods for measuring safety performance at construction sites: cited by (Priyadarshani et al, 2013).

- 1) Apply the concept of profiling, which consists of developing a corporate safety performance standard in a number of categories that are considered important by the clients' project managers. Companies are then compared according to these categories, and a profile is developed (Fletcher, cited in Priyadarshani et al., 2013).
- 2) Conduct a safety audit as a comprehensive review of the company's safety programme. A properly conducted safety audit will determine the strengths and weaknesses of a current safety programme (Kavianian & Wentz, cited in Priyadarshani et al., 2013).
- 3) Injury frequency, which is the number of lost-time injuries per million hours of exposure, is also a method of measuring safety performance (Jannadi & AlSudairi, cited in Priyadarshani et al., 2013).

According to Priyadarshani et al. (2013), additional models for measuring the effectiveness of safety management systems at construction sites have been developed in countries such as Singapore, Hong Kong, China and many other countries.

2.9 SUMMARY

Safety is a concern to all in the construction industry, from top management to the least worker on site. The construction industry is considered one of the most hazardous industries throughout the world. According to the Occupational Safety and Health Administration (OSHA), the leading safety hazards on site are falls from height, motor vehicle crashes, excavation accidents, electrocution, machines, and being struck by falling objects. Many construction sites cannot completely exclude non-workers. Road construction sites must often allow traffic to pass through. This places non-workers at some degree of risk.

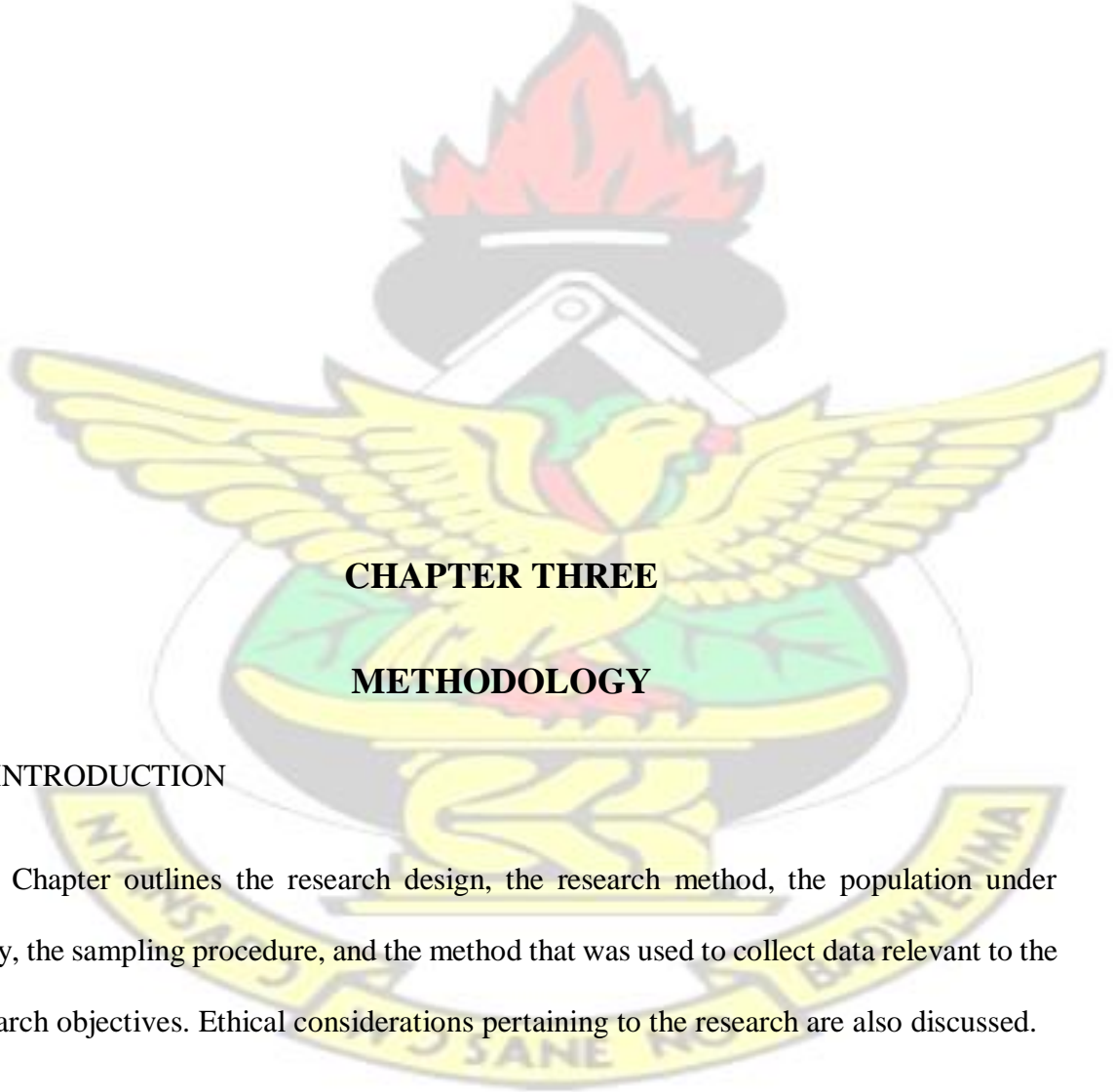
There are statutory instruments and legislative frameworks in many developed countries to govern construction operations on site and help in minimizing health and safety hazards. There are currently two major edicts that have provided guidance in the provision of occupational safety services, practice and management in Ghana. Employers in Ghana are required by the Ghana Labour Act 2003, Act 651 to ensure their employees are not exposed to conditions that would lead them to work related injuries.

Safety performance is linked with the following critical factors; Organizational, Project Level, Safety Education and Training, Role of Government and Engineering Societies, Human, Historical, Economical, Psychological, Technical, Procedural and Environmental factors. An attempt to prioritize the factors that influences safety performance on construction sites pinpoint six (6) major factors which include; Management, Incentives, Process, Policy, Technical, and Incentives related factors.

Previous Research on safety performance evaluation methods revealed Accident Rate, Incidence Rate, Experience Modification Rating and Score Card as various means of evaluating safety performance of construction companies. The existing methods comes

with limitations therefore other researchers have proposed means of overcoming the limitations associated with existing methods of evaluating construction safety performance.

KNUST

The logo of Kenya National University of Science and Technology (KNUST) is a large, faint watermark in the background. It features a yellow bird with its wings spread, perched on a green shield. Above the bird is a black mortar and pestle with a red flame. The entire emblem is encircled by a yellow banner with black text in Swahili.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This Chapter outlines the research design, the research method, the population under study, the sampling procedure, and the method that was used to collect data relevant to the research objectives. Ethical considerations pertaining to the research are also discussed.

3.2 RESEARCH DESIGN

Research design is the blueprint for conducting the study that maximizes control over factors that could interfere with the validity of the findings (Burns & Grove, 2005). Designing a study helps the researcher to plan and implement the study in a way that will help the researcher to obtain intended results, thus increasing the chances of obtaining information that could be associated with the real situation (Burns & Grove, 2005). This study basically adopted the descriptive research style or approach since it sought to report on what exist that is the safety performance of road contractors without influencing the study variables in anyway.

3.3 RESEARCH APPROACH

A quantitative approach was adopted in evaluating the safety performance of some selected road contractors in Ghana.

In order to collect relevant data for this study, the entire work was clustered into two aspects namely:

- Survey
- Case study

3.3.1 Survey

A survey in the form of questionnaires and personal observations was conducted to collect information on factors that significantly influence safety performance of road contractors.

Various road construction companies were involved in coming out with the various factors that influences safety performance. Their inputs were critically noted and helped in adapting the tool for evaluation of the safety performance.

3.3.2 Case Study

The evaluation of the safety performance was done on some selected road contractors using the adapted evaluation tool. Three road construction companies were selected for evaluation. The companies were selected based on their response during the survey stage.

3.4 RESEARCH STRATEGY

The first stage was to identify the aim of this dissertation, state the problems and the research objectives.

The next stage was to carry out extensive literature review on the topic. Comprehensive literature review on the evaluation tools and the factors affecting safety performance of road contractors was carried out.

The third Stage involved the questionnaire survey where questionnaires were distributed and collected from respondents to ascertain their knowledge on the important factors affecting safety performance.

The next step was to sample the surveyed contractors and carry out a case study on some selected road construction companies. This was then followed by the evaluation of their safety performance using the tool adapted from literature.

The final step was to analyse and discuss the results, using the Statistical Package for Social Sciences, (SPSS) software and thereafter providing the needed conclusions and recommendations.

3.5 RESEARCH LOCATION

The research was conducted in Greater Accra to give a fair representation of road contractors in Ghana. According to the Population and Housing Census (2010), Greater Accra is the second largest region in Ghana after Ashanti Region with a population of 16% (constituting 3.9 million people). The region covers a total land surface of 3,245 square kilometres and has a coastline of approximately 225 kilometres. The city of Accra being the administrative capital of Ghana is made up of 15 districts namely:

1. Accra Metropolitan,
2. Adenta Municipal
3. Ashaiman Municipal,
4. Dangme East Municipal,
5. Dangme West Municipal,
6. Ga Central Municipal
7. Ga East Municipal
8. Ga South Municipal,
9. Ga West Municipal,
10. Kpone Katamanso District
11. La Dade Kotopon Municipal
12. La Nkwatanang Madina District
13. Ledzokuku – Krowor Municipal,

14. Ningo Prampram Distric

15. Tema Metropolitan.

The actual study was done in the Accra Metropolis. Accra Metropolis has a total land size of 200 square kilometres and made up of six sub- metros, namely; Okaikoi, Ashiedu Keteke, Ayawaso, Kpeshie, Osu Klotey and Ablekuma.

3.6 POPULATION

The population is the aggregate or totality of all the objects, subjects or members that conform to a set of specifications (Pilot & Hunglar, 1999). In this study the population was all categories of road construction companies in the Greater Accra Region of Ghana. According to data from Association of Road Contractors (ASROC) Ghana, there are over sixty four (64) registered road construction companies in the Accra Metropolis registered with the association.

All the sixty four (64) companies were chosen for the study.

3.7 SAMPLING TECHNIQUE

Simple random probability sampling was used to reach out to the various construction firms in the study area.

3.8 SAMPLE SIZE

The entire population available at the time of the research was used. This is basically a census approach hence the sample size was sixty four (64).

3.8.1 The Eligibility Criteria

These criteria specify the characteristics that people in the population must possess in order to be included in the study. The eligibility criteria in this study were that the respondents had to:

- Be a registered road construction company operating in Ghana
- Be within a financial class categorization of A1B1, A2B2, A3B3 and A4B4.
- Be registered with Ministry of Roads and Transport.
- Be based in Accra with Headquarters in the Greater Accra region.

3.9 DATA COLLECTION

Data is defined as information obtained in a course of a study. In this study data was collected by using structured questionnaires. A structured questionnaire was used in order to capture data relevant to the very first objective of the study and research questions.

3.9.1 Data Source

To devise a rational framework or tool for evaluating the safety performance of road contractors necessitates the establishment of the importance of safety factors in an objective manner as possible.

The various methods that were used to collect data for this research consist of:

- Primary Data Collection
- Secondary Data Collection

3.9.1.1 Secondary Data

Literature was reviewed through secondary sources like textbooks, electronic journals, conference papers, reports, newspapers and publications. The internet has been a very useful tool in collecting data.

3.9.1.2 Primary Data

The primary data for this study was gathered through questionnaires and personal observations. Primary Data was collected by the use of printed questionnaire comprising a series of questions and factors that were submitted to a number of respondents to obtain data on the significant factors that influences the safety performance of road contractors.

A questionnaire survey was chosen as an appropriate means for soliciting views of various project participants within a relatively short period of time. When developing the questionnaire, safety factors identified through previous studies were duly considered.

Observations were made on some construction sites visited to take note of their compliance with safety practices.

3.9.1.3 Questionnaire Design

From the literature reviewed, relevant information that could aid the study objectives were collected and reviewed.

The close ended questionnaire was employed and this was made up of different sections to capture the objectives of the research. The questionnaire was provided with a covering letter which explained the purpose of the study, the method of responding, the aim of the

research and the security of the information in order to encourage better response. The questionnaire was designed into three sections as in appendix B.

For each factor there is a scale for measuring the degree of impact on safety performance on a project. Respondents were asked to state any other factors that affect safety performance and to rank these factors. The degree of impact is based on a fivepoint Likert scale.

Table 3.1 Five-Point Likert Scale

Highly Important	5
Very Important	4
Not Very Important	3
Important	2
Not Important	1

3.10 ETHICAL CONSIDERATIONS

When humans are used as study participants in a research investigation, care must be exercised that the rights of those individuals are protected. The privacy and confidentiality of the respondents of this study was protected by keeping in secrecy the information collected. Deception was avoided by informing construction companies about the purpose of the research and its implications on the respondents. This helped the respondents to make informed decisions with respect to the questions asked. Respondents voluntarily partook in the research without any form of coercion or manipulation. All sources of information were duly acknowledged.

3.11 DATA ANALYSIS

The data collected was processed by first numbering them and assigning codes to the responses. Coding is a convenient way of representing information so as to facilitate data entry and analysis.

Data was analysed by determining the mean score, standard deviation and percentages using the Statistical package for social sciences (SPSS) software and results regarding critical issues of the study were presented through frequency distribution tables, charts and graphs.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

In this chapter, data collected were analyzed and discussed. The analysis was based on the research objectives that informed the study. In discussing the issues emerging from the data, ideas expressed by authorities in the literature review in Chapter two were considered for purposes of confirming or contrasting ideas. The results covered demographic data on respondents, ranking of various factors that influence safety performance and an evaluation of the safety performance of road construction companies.

A total of sixty four (64) questionnaires were distributed but thirty nine (39) was recovered representing sixty one (61%) percent. Thus the analysis presented in this chapter is based on the 39 respondents.

4.2 DEMOGRAPHIC INFORMATION

It was deemed necessary to gather background information on the respondents. Although, little use had been made of the background data in analyzing responses to the research questions, the data had a purpose. It provided an understanding of the respondents who participated in the study. The biographic data were limited to the position of respondent in the company, level of education, membership to professional body, company financial classification and years of experience as a company.

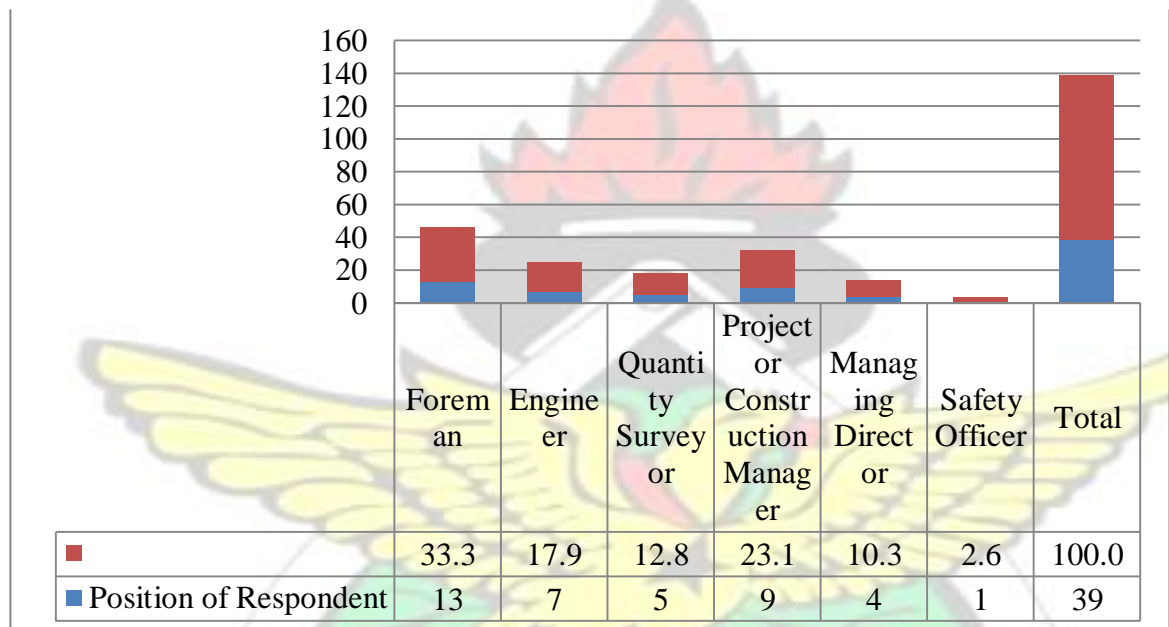


Figure 4.1 Position of Respondent

Source: Field work, 2014

Position of Respondent

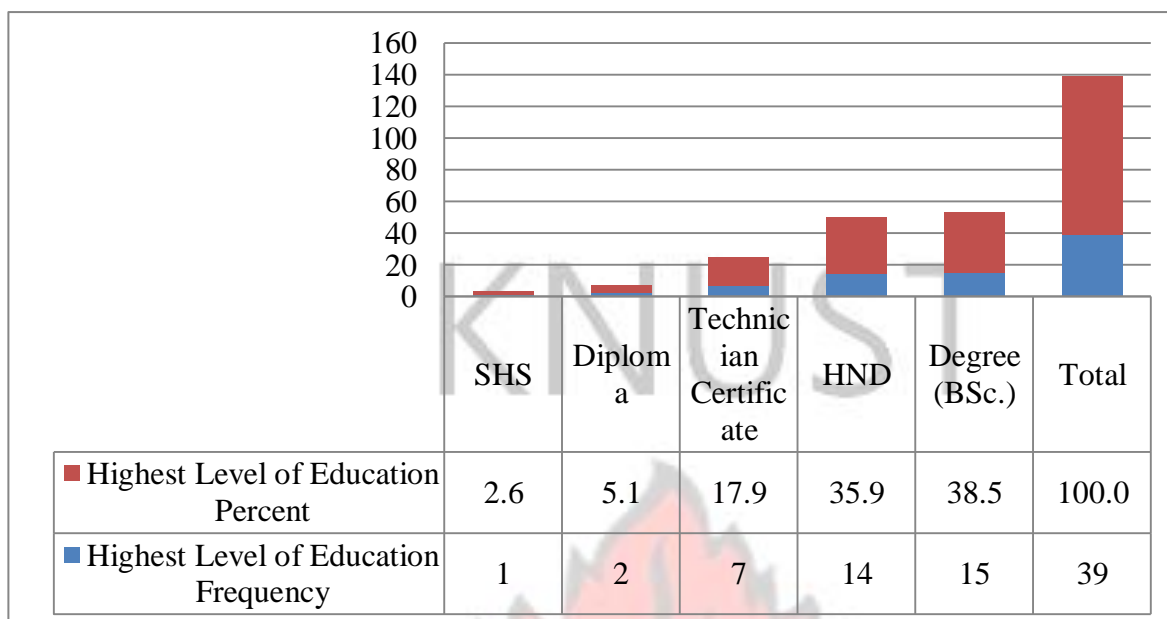


Figure 4.2 Highest Level of Education
Source: Field work, 2014

From Figure 4.1, a majority of thirteen (13) respondents representing thirty three point three percent (33.3%) were Foremen, Nine (9) representing twenty three point one (23.1) were Project and Construction managers, seventeen point nine percent (17.9%) were Engineers, twelve point eight percent (12.8%) were Quantity Surveyors, ten point three percent (10.3%) were Managing Directors and two point six percent (2.6%) as Safety Officers.

On the highest level of education as presented in Figure 4.2, thirty eight point five percent (38.5%) representing the majority were BSc. graduates, thirty five point nine percent (35.9%) were HND graduates and seventeen point nine percent (17.9%) were Technician Certificate holders.

Table 4.1 Analysis of General information about respondents

VARIABLES	OPTIONS	FREQUENCY	PERCENTAGES
Membership of Professional Body	GhIE	7	64
	GhIS	4	36

	CIOB	0	0
	ARC	0	0
	GIOB	0	0
Company Classification	A1 B1	6	16
	A2 B2	19	51
	A3 B3	12	32
	A4 B4	0	0
Special Class with Roads and Transport	Labour Only (C)	1	3
	Steel Work (S)	0	0
Years of Experience	1yr – 5yrs	3	8
	6yrs – 10yrs	19	49
	11yrs – 20yrs	14	36
	21yrs – 30 yrs	2	5
	31yrs – 40yrs	1	3

Source: Field work, 2014

From Table 4.1, seven representing sixty four percent (64%) of the respondents were members of GhIE and four representing thirty six percent (36%) are members of GhIS.

Fifty one percent (51%) majority of the respondents are class A2/B2 contractors, thirty two percent (32%) are class A3/B3 and sixteen percent (16%) belongs to category A1/B1.

It can be deduced from Table 4.1 that, forty nine percent (49%) of the respondents have working experience between six to ten years (6 – 10 years) while thirty six percent (36%) are between eleven to twenty years (11 – 20 years).

4.3 FACTORS INFLUENCING SAFETY PERFORMANCE

The factors identified in the literature review were tabulated and distributed to respective respondents to measure for their degree of impact on safety performance in the

construction industry by the various respondents. Respondents were requested to respond on a five-point Likert scale of Highly Important, Very Important, Not very Important, Important and Not Important. A scoring system was used to transform the Likert scale into a quantitative variable, where Highly Important scored 5 points and Not Important scored 1 point.

4.4 RANKING OF FACTORS THAT INFLUENCES SAFETY PERFORMANCE

The factors that had a mean score above three (3.0) were selected from the analysis and used for a case study on three companies. The factors were ranked according to the mean score. In cases where the mean score of two or more factors in a group were the same, the standard deviation was used. Any factor that had a mean score of three (3.0) and below were removed from the evaluation tool.

Table 4.2 Ranking of Factors that influences safety performance

VARIABLES	MEAN	STANDARD DEVIATION	RANKING
ORGANIZATIONAL LEVEL			
Development of safety policy	4.79	.469	1
Provision of safe working environment	4.69	.614	2
Employment of safety officers	4.44	.852	3
Employment of certified skilled labour	4.2895	.73182	4
Length and detail of the company safety program	3.95	.686	5
Number of informal safety inspections made by the company safety coordinator	3.92	.739	6
Management talks on safety		.978	7
Punishments for bad safety habits		.84173	8
	3.87		
	3.7692		
Incentives for good safety performance	3.7692	.90209	9
Conduction of organizational policy review	3.72	.887	10
Organizational safety awareness & commitment	3.67	.927	11

More supportive upper management attitude towards safety	3.59	.880	12
Minimizing worker turnover	3.5385	.82226	13
Implementation of safety management systems	3.5385	.88396	14
Implementation of safety audit to safety management systems	3.47	.762	15
Reluctance to input resources to safety	3.44	.788	16
Top management checks of safety records	3.41	.880	17
PROJECT LEVEL			
Appointing a trained safety representative on site	4.6923	.69410	1
Toolbox meetings	4.4872	.99662	2
Reduced project team turnover (team stability)	4.3947	.67941	3
New technologies in the execution of building projects	4.2821	.85682	4
Identification of unsafe practices on site	4.1282	.80064	5
Conducting site safety inspection and supervision	3.9231	.62343	6
Meetings with the field safety representatives and craft workers	3.8947	.72743	7
Identification of hazardous and dangerous activities	3.8718	.86388	8
Provision and Keeping of daily safety records and booklets	3.8462	.93298	9
Poor safety awareness of project managers	3.7692	1.06281	11
Control of hazardous activities on site	3.7692	.77668	10
<i>Continued</i>			
VARIABLES	MEAN	STANDARD DEVIATION	RANKING
Increase time devoted to safety for the project safety representative	3.6316	.78572	12
Development of emergency plan and procedures	3.4359	.99459	13
More formal meetings with supervisors and specialty contractors	3.4211	.82631	14
Frequency of a foreman's announcing safety related matters to workers	3.4103	.81815	15
Frequency of a worker's partners reminding him of personal safety	3.4103	.88013	16
Conducting accident investigation and analysis	3.3590	.90284	17
Frequency of a crew's receiving notices of hazard removal	3.3590	.90284	18
Frequency of a foreman's presence in safety meeting	3.3421	.78072	19
Disciplinary action for not conforming to safety practices	3.2821	.82554	20

More informal safety meetings with supervisors	3.2368	.88330	21
Frequency of a foreman's reminding new workers of safety regulations	3.2105	.93456	22
Frequency of a foreman's correcting workers' unsafe actions	3.1579	.78933	23
Excessive overtime work for labour	3.0513	.79302	24
SAFETY EDUCATION AND TRAINING			
Safety Posters and safety boards	4.8462	.53991	1
First aid training for all workers	4.6667	.77233	2
Safety training for new foremen and safety coordinators	4.3590	.95936	3
Lack of training	4.1795	1.23271	4
Training with the assistance of contractor associations	4.1282	1.00471	5
Brochures and publications on safety	4.0000	1.16980	6
Guidance and training of workers on safety	3.7179	.75911	7
Hours of safety education per year a worker receives	3.1795	.75644	8
ECONOMIC FACTORS			
Safety investment on personal protective equipment	3.5641	1.04617	1
Enough money allocation for Company safety expenditures	3.3333	.70088	2
Increased budget allocation to safety awards	3.1538	.77929	3

Table 4.2 Continued

VARIABLES	MEAN	STANDARD DEVIATION	RANKING
WELFARE FACILITIES			
Provision of safety clothing and equipment	4.7436	.54858	1
Provision of adequate facilities for first aid treatment	4.6316	.78572	2
Provision of good shelter	4.5641	.85208	3
Provision of food and drinking water	4.5000	.89292	4
Provision of adequate toilets	4.4872	.79046	5
Provision of special places for smoking	3.2308	1.44115	6
MEDICAL FACILITIES			
Periodic medical examination of workers	3.1538	1.13644	2
ROLE OF GOVERNMENT & ENGINEERING SOCIETIES			

Issuing Laws, Standards, Regulations and Legislations on safety	4.4359	.78790	1
Supervision to ensure compliance with occupational safety legislation, codes and standards	4.1282	.89382	2
FIRE PREVENTION			
Availability of adequate fire extinguishers on site	4.5897	.63734	1
Good storage of flammable liquids and combustible materials	4.2821	.97194	2
Periodic maintenance of fire extinguishers on site	4.1795	.64367	3
TECHNICAL FACTORS			
Carrying out work in a safe manner	4.5128	.94233	1
Carrying out work in a professional manner	4.1795	.96986	2
Provision of technical guidance	4.1282	.95089	3
Availability of maintenance policy	4.0256	1.03840	4
Proper handling of tools, equipment and plant	3.9231	.77407	5
Maintenance of tools, equipment and plant	3.9231	.87011	6
Use of bad or poor equipment	3.6154	1.16111	7
Protection of materials in storage and transit	3.5641	.82062	8
Type and method of construction	3.2308	.80986	9
HISTORIC, HUMAN & PSYCHOLOGICAL FACTORS			
Worker safety training received	3.4872	1.07292	1
Worker safety awareness knowledge & involvement	3.2051	.76707	2
Relation between workers and foremen on site	3.0256	.90284	3
Availability of medical service on site	3.6410	.84253	1

Source: Field work (2014)

4.5 EVALUATION OF SAFETY PERFORMANCE

4.5.1 Case Study

Three road construction companies were randomly selected out of the lots that were initially surveyed for a case study. The companies were evaluated to determine their safety performance over the years. For the purpose of discussing the results, the three companies have been coded as A, B and C.

The factors that had a mean score above three (3.0) were selected from the analysis and presented for a case study on three companies A B and C.

4.6 DISCUSSION OF RESULTS

In evaluating the safety performance of road contractors, the scale below was used.

Respondents were requested to respond on a scale of:

No = Not in place.

Yes = In Place.

1 = In place but limited or little/no documentation.

2 = In place, including documentation, no audit or review.

3 = In Place, proven performance, up to date documentation, periodic audits.

A scoring system was used to transform the scale into a quantitative variable, where “In Place, proven performance, up to date documentation, periodic audits” scored 5 points and “Not in place” 1 point.

The total group marks obtained from each group was computed in percentages for each company to determine the safety performance level in percentages of the various companies.

The percentage scores of each company were then computed to determine the safety performance of the road construction industry in Ghana.

4.7 CASE STUDY: COMPANY “A”

4.7.1 Company Profile

The first company that was evaluated has over twenty (20) years working experience in the road construction industry. It is a private company with limited liability.

The company has an average workforce of two hundred and thirty two (232) workers comprising of top management, site managers or supervisors, technicians, plant operators and mechanics down to the unskilled worker or labourer.

The company is registered in Ghana and is located in the Greater Accra Metropolis with an average employee exposure hours of eight (8 hours) a day. It works from Monday to Friday representing five (5) working days in a week.

The financial class of this company is A1/B1 and undertakes major road construction works in Ghana.

Over the last three years, the company recorded four (4) fatalities and twenty (20) lost workday cases.

4.7.2 Evaluation Results

Table 4.3 below indicates the safety performance of the first company that was evaluated. The safety performance of this company based on various factors as grouped into the appropriate headings is clearly indicated. The various factors has been put under nine different headings and scored as such to determine their performance.

Table 4.3 Safety Performance of Company One

S/N	Group	Percentage Score for Each Scale					Total Score %
		1	2	3	4	5	
A	Management Commitment	2	14	26	10	0	52
B	Safety Responsibility	2.5	10	22.5	20	0	55
C	Safety Programs & Work Practices	2	36	0	0	0	38
D	Safety Education And Training	6	13	16	8	0	43
E	Job Training & Qualification	14	12	0	0	0	26
F	Incident Reporting & Investigation	0	40	0	0	0	40
G	Inspection & Hazard Identification	8	19	8	0	0	35
H	Medical And Welfare Facilities	0	17	34	0	0	51
I	Technical Factors	8.9	13.3	13.3	0	0	36
TOTAL COMPANY SCORE %							42%

Source: Field Data, 2014

From Table 4.3, it can be deduced that company “A” scored 52% for management commitment, 55% for Safety responsibility, 38% for Safety programs and work practices, 43% for Safety Education and Training, 26% for Job Training and Qualification, 40% for Incident Reporting and Investigation, 35% for Inspection and Hazard Identification, 51% for Medical and welfare Facilities and 36% for Technical Factors.

In all the group factors that were evaluated, company “A” scored 42%.

4.8 CASE STUDY: COMPANY “B”

4.8.1 Company Profile

The second company that was evaluated has been into road construction for over ten (10) years and is a private company with limited liability.

The company has an average number of one hundred and forty seven (147) workers comprising of top management, site managers or supervisors, technicians, plant operators and mechanics down to the unskilled worker or labourer.

The company is registered in Ghana and is located in the Greater Accra Metropolis with an average employee exposure hours of eight (8 hours) a day. They work from Monday to Friday representing five (5) working days in a week.

The financial class of this company is A2/B2 and undertakes major road construction works in Ghana.

Over the last three years, the company recorded four (4) fatalities and thirty three (33) lost workday cases.

4.8.2 Evaluation Results

The evaluated results are as shown in Table 4.4 which indicates the safety performance of the second company that was evaluated. The safety performance of this company, based on various factors as grouped into the appropriate headings is clearly presented.

The various factors has been put under nine different headings and scored as such to determine their performance.

Table 4.4 Safety Performance of Company Two

S/N	Group	Percentage Score for Each Scale					Total Score %
		1	2	3	4	5	
A	Management Commitment	9	15.5	7.5	0	0	32
B	Safety Responsibility	5	15	15	10	0	45
C	Safety Programs & Work Practices	6	24	6	0	0	36
D	Safety Education And Training	4	13	22	4	0	43
E	Job Training & Qualification	10	16	6	0	0	32
F	Incident Reporting & Investigation	0	40	0	0	0	40
G	Inspection & Hazard Identification	9	16	8	0	0	33
H	Medical And Welfare Facilities	3	11.5	34.5	0	0	49
I	Technical Factors	7	18	13	0	0	38
TOTAL COMPANY SCORE %							39%

Source: Field Data, 2014

From Table 4.4, it can be deduced that company “B” scored 32% for management commitment, 45% for Safety responsibility, 36% for Safety programs and work practices, 43% for Safety Education and Training, 32% for Job Training and Qualification, 40% for Incident Reporting and Investigation, 33% for Inspection and Hazard Identification, 49% for Medical and welfare Facilities and 38% for Technical Factors.

In all the group factors that were evaluated, company “B” scored 39%.

4.9 CASE STUDY: COMPANY “C”

4.9.1 Company Profile

The third road construction company that was evaluated has been working in the road construction industry for over ten (10) years and is a private company with limited liability.

The company has an average number of eighty two (82) workers comprising of top management, site managers or supervisors, technicians, plant operators and mechanics down to the unskilled worker or labourer.

The company is registered in Ghana and is located in the Greater Accra Metropolis with an average employee exposure hours of eight (8 hours) a day. They work from Monday to Friday representing five (5) working days in a week.

The financial class of this company is A3/B3 and undertakes major road construction works in Ghana.

Over the last three years, the company recorded four (4) fatalities and eight (8) lost workday cases.

4.9.2 Evaluation Results

The results of the safety performance evaluation of company “C” is as displayed in Table 4.5. The safety performance of this company based on various factors as grouped into the appropriate headings is clearly presented. The various factors has been put under nine different headings and scored as such to determine their performance.

Table 4.5 Safety Performance of Company Three

S/N	Group	Percentage Score for Each Scale					Total Score
		1	2	3	4	5	%
A	Management Commitment	8	17.5	10.5	0	0	36
B	Safety Responsibility	5	15	15	10	0	45
C	Safety Programs & Work Practices	10	20	0	0	0	30
D	Safety Education And Training	3	15	22	8	0	48
E	Job Training & Qualification	6	20	6	8	0	40
F	Incident Reporting & Investigation	4	0	36	16	0	56
G	Inspection & Hazard Identification	8	13.5	5.5	0	0	27
H	Medical And Welfare Facilities	3	11	26	11	0	51
I	Technical Factors	7	22	7	0	0	36
TOTAL COMPANY SCORE %							41%

Source: Field Data, 2014

From table 4.5, it can be deduced that company “C” scored 36% for management commitment, 45% for Safety responsibility, 30% for Safety programs and work practices, 48% for Safety Education and Training, 40% for Job Training and Qualification, 56% for Incident Reporting and Investigation, 27% for Inspection and Hazard Identification, 51% for Medical and welfare Facilities and 36% for Technical Factors. In all the group factors that were evaluated, company “C” scored 41%.

4.10 SAFETY PERFORMANCE OF ROAD CONSTRUCTION COMPANIES IN GHANA

The overall aim of this study was to empirically evaluate the safety performance of road construction companies in Ghana. After a thorough research and finally evaluating the safety performance of road construction companies in Ghana, the results indicates that the

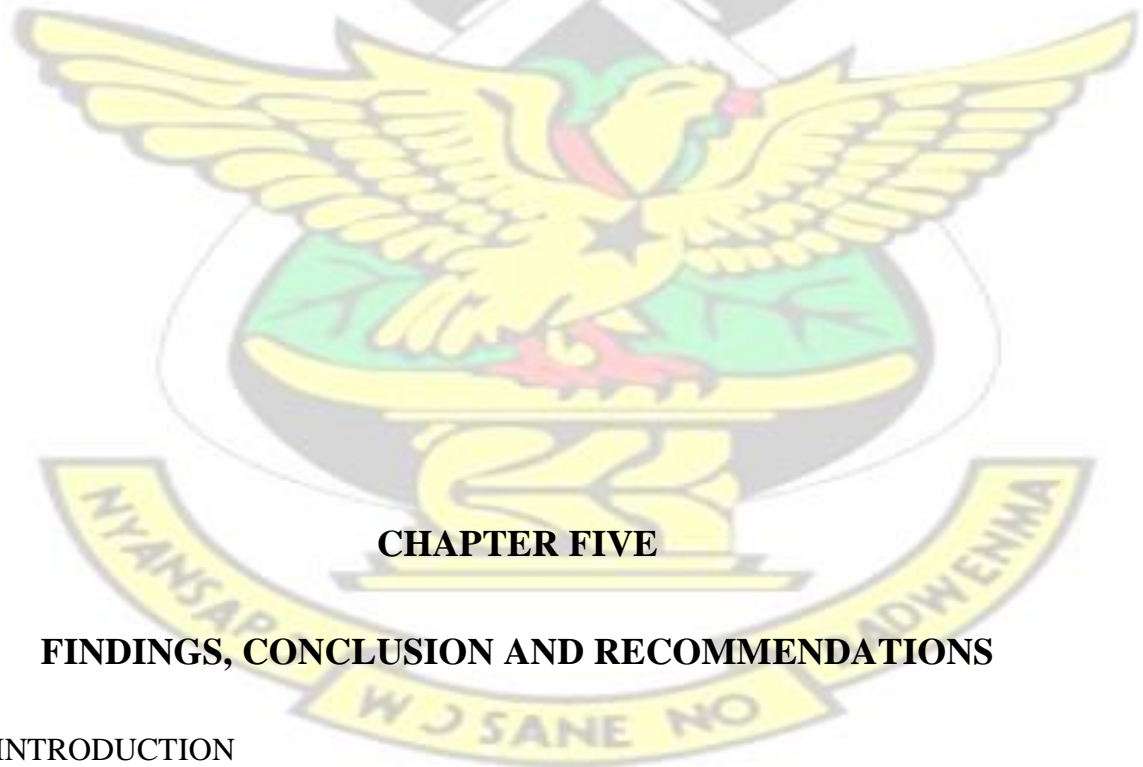
road construction sector on the average scored forty one percent (41%) for safety performance as measured on the various sites.

The result is as displayed in table 4.6.

Table 4.6 Evaluated safety performance of road contractors

Company	Percentage score
A	42
B	39
C	41
Total (A + B + C)	122
Total Average Score	41%

Source: Field Data, 2014



CHAPTER FIVE

FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents the key findings that emerged from the study. It also draws out the main conclusion from the study and provides recommendations for improving safety performance of road contractors in Ghana. The study sought to empirically evaluate the safety performance of road construction companies in Ghana and make recommendations based on the findings.

5.2 KEY FINDINGS

The key findings of the study are:

- Among the various factors identified from literature, it could be deduced that Safety performance is dependent on the following critical factors; organizational, Project Level, Safety Education and Training, Role of Government and Engineering Societies, Human, Historical, Economical, Psychological, Technical, Procedural and Environmental factors.
- Most companies follow established safety guidelines and policies that meet Occupational Health and Safety guidelines.
- However, most Safety Management Assessment Framework incidents and injuries at construction sites are a direct result of not adhering to the established safety procedures.
- The Accident Rate, Incidence Rate, Experience Modification Rating and Score Card are some methods and tools for evaluating the safety performance of construction contractors in general. There is no specific method for evaluating the safety performance of road construction companies.

- The overall safety performance of the road construction sector in Ghana is evaluated to be at forty one percent (41%).
- Medical and Welfare Facilities scored six percent (6%) emerging as the group that scored the highest in terms of safety.
- Safety Responsibility, Safety Education and Training, Incident Reporting and Investigation scored five percent (5%) each respectively.
- Management Commitment, Safety Programs and Work Practices, Job Training and Qualification, Inspection and Hazard Identification and Technical Factors scored four percent (4%) each respectively.
- Most companies do not employ the services of a competent safety officer.
- Various companies do not have safety policies.
- There is no compiled document or law on occupational safety in Ghana but instead the laws are scattered in various documents.

5.3 CONCLUSION

A list of ninety five (95) factors was identified from literature that set the basis of a questionnaire survey. The mean score and standard deviation of each factor was calculated and used to rank the factors. Factors that were considered not really important after the ranking were not used. After analysis of the factors influencing safety performance, the ranking was reduced to seventy seven (77) factors.

The various factors that were considered relevant were used to evaluate the safety performance of road construction companies in Ghana. A total of one hundred and six (106) questions were found on the evaluation tool and the various companies that were selected for the case study were evaluated. All the questions were categorized into nine

(9) groups for the evaluation. Each question was evaluated to give a total group score for each category. The percentage score for all the nine groups were also computed to form the basis for the outcome of this study.

The most important group factors affecting the safety performance of road contractors were found to be 1) Provision of safety and welfare facilities, 2) Safety Responsibility of management and individuals, 3) Safety Programs and Work Practices, 4) Incident Reporting and Investigation and 5) Management Commitment.

Since the overall aim of this research is to empirically evaluate the safety performance of road construction companies in Ghana, the study reveals that the safety performance of road construction companies in Ghana stands at forty one percent (41%) on the average.

5.4 RECOMMENDATIONS

Several issues emerged from the summarized findings and conclusions. The following constitutes the recommendations for this study:

- The level of safety performance by road construction companies in Ghana is low therefore there is the need to improve safety performance in the road construction industry.
- In order to improve safety performance in the road construction sector, it is important for managers of the various companies to pay particular attention to the provision of safety and welfare facilities, safety responsibility of management and individuals, safety programs and work practices, incident reporting and investigation. Management should be committed to ensuring that good safety measures are practiced at all work places.

- The ministry of roads and highways should make it a priority to providing education and training on safety practices to various companies.
- Management of various companies should include more monitoring of safety performance at the site by periodically and randomly conducting safety inspections to ensure the implementation of safety standards.
- In-house regular safety inspections should be carried out by a competent person and the necessary corrective actions should be taken promptly.
- The laws on safety are too scattered in lots of documents hence Government and all regulatory bodies should come out with a well compiled and concise document, regulations and laws on safety practices for the road construction industry to regulate the activities of the industry players.
- The law should make a provision for every road construction company to employ the services of a competent safety officer. Also, companies should be tasked to provide safety policy for their organizations.
- Finally, the ministry of roads and highways should make it a compulsory requirement for road construction companies to present safety certificate as a prerequisite to awarding contracts.

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APPENDICES

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APPENDIX A (Tabular Presentation of Calculations for Evaluating the Safety Performance of the Three Companies)

Tabular Presentation of Calculations for Evaluating the Safety Performance of Company "A"

GROUPS		SCALE					TOTAL
		1	2	3	4	5	
Management commitment 115marks =100%	Scaling (Marks)			30		0	60marks
		2	16		12		
	Percentage	$\frac{2}{115} \times 100$ =2%	$\frac{16}{115} \times 100$ =14%	$\frac{30}{115} \times 100$ =26%	$\frac{12}{115} \times 100$ =10%	0	52%
Safety Responsibility 40marks =100%	Scaling (Marks)		4	9	8	0	22marks
		1					
	Percentage	$\frac{1}{40} \times 100$ =2.5%	$\frac{4}{40} \times 100$ =10%	$\frac{9}{40} \times 100$ =22.5%	$\frac{8}{40} \times 100$ =20%	0	55%
Safety Programs & Work Practices 50marks =100%	Scaling (Marks)			0	0	0	19marks
		1	18				
	Percentage	$\frac{1}{50} \times 100$ =2%	$\frac{18}{50} \times 100$ =36%	0	0	0	38%
Safety Education And Training 95marks =100%	Scaling (Marks)			15	8	0	41marks
		6	12				
	Percentage	$\frac{6}{95} \times 100$ =6%	$\frac{12}{95} \times 100$ =13%	$\frac{15}{95} \times 100$ =16%	$\frac{8}{95} \times 100$ =8%	0	43%
Job Training & Qualification 50marks =100%	Scaling (Marks)		6	0	0	0	13marks
		7					
	Percentage	$\frac{7}{50} \times 100$ =14%	$\frac{6}{50} \times 100$ =12%	0	0	0	26%
Incident Reporting & Investigation 25marks =100%	Scaling (Marks)	0		0	0	0	10marks
			10				
	Percentage	0	$\frac{10}{25} \times 100$ =40%	0	0	0	40%
Inspection & Hazard Identification 75marks =100%	Scaling (Marks)			6	0	0	26marks
		6	14				
	Percentage	$\frac{6}{75} \times 100$ =8%	$\frac{14}{75} \times 100$ =19%	$\frac{6}{75} \times 100$ =8%	0	0	35%

Medical And Welfare Facilities 35marks =100%	Scaling (Marks)	0	6	12	0	0	18marks
	Percentage	0	$\frac{6}{35} \times 100 = 17\%$	$\frac{12}{35} \times 100 = 34\%$	0	0	51%
Technical Factors 45marks =100%	Scaling (Marks)	4	6	6	0	0	16marks
	Percentage	$\frac{4}{45} \times 100 = 8.9\%$	$\frac{6}{45} \times 100 = 13.3\%$	$\frac{6}{45} \times 100 = 13.3\%$	0	0	36%

Tabular Presentation of Calculations for Evaluating the Safety Performance of Company “B”

GROUPS		SCALE					TOTAL
		1	2	3	4	5	
Management commitment 115marks =100%	Scaling (Marks)	10	18	9	0	0	37marks
	Percentage	$\frac{10}{115} \times 100 = 9\%$	$\frac{18}{115} \times 100 = 15.5\%$	$\frac{9}{115} \times 100 = 7.5\%$	0	0	32%
Safety Responsibility 40marks =100%	Scaling (Marks)	2	6	6	4	0	18marks
	Percentage	$\frac{2}{40} \times 100 = 5\%$	$\frac{6}{40} \times 100 = 15\%$	$\frac{6}{40} \times 100 = 15\%$	$\frac{4}{40} \times 100 = 10\%$	0	45%
Safety Programs & Work Practices 50marks =100%	Scaling (Marks)	3	12	3	0	0	18marks
	Percentage	$\frac{3}{50} \times 100 = 6\%$	$\frac{12}{50} \times 100 = 24\%$	$\frac{3}{50} \times 100 = 6\%$	0	0	36%
Safety Education And Training 95marks =100%	Scaling (Marks)	4	12	21	4	0	41marks
	Percentage	$\frac{4}{95} \times 100 = 4\%$	$\frac{12}{95} \times 100 = 13\%$	$\frac{21}{95} \times 100 = 22\%$	$\frac{4}{95} \times 100 = 4\%$	0	43%
Job Training & Qualification 50marks =100%	Scaling (Marks)	5	8	3	0	0	16marks
	Percentage	$\frac{5}{50} \times 100 = 10\%$	$\frac{8}{50} \times 100 = 16\%$	$\frac{3}{50} \times 100 = 6\%$	0	0	32%
Incident Reporting &	Scaling (Marks)	0		0	0	0	10marks

Investigation 25marks =100%	Percentage	0	$\frac{10}{10/25 \times 100}$ =40%	0	0	0	40%
Inspection & Hazard Identification 75marks =100%	Scaling (Marks)	7	12	6	0	0	25marks
		$\frac{7}{7/75 \times 100}$ =9%	$\frac{12}{12/75 \times 100}$ =16%	$\frac{6}{6/75 \times 100} = 8\%$	0	0	33%
Medical And Welfare Facilities 35marks =100%	Scaling (Marks)	1	4	12	0	0	17marks
		$\frac{1}{1/35 \times 100}$ =3%	$\frac{4}{4/35 \times 100}$ =11.5%	$\frac{12}{12/35 \times 100}$ =34.5%	0	0	49%
Technical Factors 45marks =100%	Scaling (Marks)	3	8	6	0	0	17marks
		$\frac{3}{3/45 \times 100}$ =7%	$\frac{8}{8/45 \times 100}$ =18%	$\frac{6}{6/45 \times 100}$ =13%	0	0	38%
	Percentage						

Tabular Presentation of Calculations for Evaluating the Safety Performance of Company "C"

GROUPS		SCALE					TOTAL
		1	2	3	4	5	
Management commitment 115marks =100%	Scaling (Marks)	9	20	12	0	0	41marks
	Percentage	$\frac{9}{9/115 \times 100}$ =8%	$\frac{20}{20/115 \times 100}$ =17.5%	$\frac{12}{12/115 \times 100}$ =10.5%	0	0	36%
Safety Responsibility 40marks =100%	Scaling (Marks)	2	6	6	4	0	18marks
	Percentage	$\frac{2}{2/40 \times 100}$ =5%	$\frac{6}{6/40 \times 100}$ =15%	$\frac{6}{6/40 \times 100}$ =15%	$\frac{4}{4/40 \times 100} = 10\%$	0	45%
Safety Programs & Work Practices 50marks =100%	Scaling (Marks)	5	10	0	0	0	15marks
	Percentage	$\frac{5}{5/50 \times 100}$ =10%	$\frac{10}{10/50 \times 100}$ =20%	0	0	0	30%

Safety Training	Education	And	Scaling (Marks)	3	14	21	8	0	46marks
				$\frac{3}{95 \times 100}$	$\frac{14}{95 \times 100}$	$\frac{21}{95 \times 100}$	$\frac{8}{95 \times 100} = 8\%$	0	
			Percentage	=3%	=15%	=22%		0	48%
Job Training & Qualification			Scaling (Marks)	3	10	3	4	0	20marks
				$\frac{3}{50 \times 100}$	$\frac{10}{50 \times 100}$	$\frac{3}{50 \times 100} = 6\%$	$\frac{4}{50 \times 100} = 8\%$	0	
			Percentage	=6%	=20%			0	40%
Incident Investigation	Reporting	&	Scaling (Marks)	1	0	9	4	0	14marks
				$\frac{1}{25 \times 100}$	0	$\frac{9}{25 \times 100}$	$\frac{4}{25 \times 100} = 16\%$	0	
			Percentage	=4%		=36%		0	56%
Inspection & Identification		Hazard	Scaling (Marks)	6	10	4	0	0	20marks
				$\frac{6}{75 \times 100}$	$\frac{10}{75 \times 100}$	$\frac{4}{75 \times 100}$	0	0	
			Percentage	=8%	=13.5%	=5.5%		0	27%
Medical Facilities	And	Welfare	Scaling (Marks)	1	4	9	4	0	18marks
				$\frac{1}{35 \times 100}$	$\frac{4}{35 \times 100}$	$\frac{9}{35 \times 100}$	$\frac{4}{35 \times 100} = 11\%$	0	
			Percentage	=3%	=11%	=26%		0	51%
Technical Factors	45marks		Scaling (Marks)	3	10	3	0	0	16marks
				$\frac{3}{45 \times 100}$	$\frac{10}{45 \times 100}$	$\frac{3}{45 \times 100} = 7\%$	0	0	
			Percentage	=7%	=22%			0	36%

Tabular Presentation of Company Scores for Evaluating the Safety Performance of the three Companies

GROUPS	TOTAL ASSIGNED PERCENTAGE	GROUP SCORES %		
		A	B	C
Management Commitment	100%	52	32	36
Safety Responsibility	100%	55	45	45

Safety Programs and Work Practices	100%	38	36	30
Safety Education and Training	100%	43	43	48
Job Training and Qualification	100%	26	32	40
Incident Reporting & Investigation	100%	40	40	56
Inspection and Hazard Identification	100%	35	33	27
Medical and Welfare Facilities	100%	51	49	51
Technical Factors	100%	36	38	36
TOTAL	900%	376%	348%	369%
COMPANY SCORE %		$376/900 \times 100$ =42%	$348/900 \times 100 =$ 39%	$369/900 \times 100$ =41%



APPENDIX B (Questionnaire Survey)

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY COLLEGE OF ARCHITECTURE AND PLANNING

DEPARTMENT OF BUILDING TECHNOLOGY

QUESTIONNAIRE

This questionnaire is part of the research work for partial fulfillment of the award of MSc. in Construction Management on the topic “***SAFETY PERFORMANCE OF ROAD CONTRACTORS IN GHANA***”.

The overall purpose of this study is to empirically evaluate the safety performance of road construction companies in Ghana.

All responses will be kept *strictly confidential* and *exclusively* for academic use. Further information can be obtained from the researcher on telephone number 0242152219, or the supervisor, DR. E. ADINYIRA of KNUST (eadinyira.feds@knust.edu.gh). The researcher wishes you will consider his request and cooperate.

This questionnaire is in Three (3) sections; A, B and C.

SECTION A: GENERAL OR PERSONAL INFORMATION

SECTION B: LIST OF SOME FACTORS THAT ARE LIKELY TO INFLUENCE SAFETY PERFORMANCE

SECTION C: PROVISION FOR YOUR SPECIAL FACTORS AND COMMENTS

Please **tick** ☐ $\sqrt{}$ where appropriate.

INTERPRETATION OF SCALE

HIGHLY IMPORTANT	5
VERY IMPORTANT	4
NOT VERY IMPORTANT	3
IMPORTANT	2
NOT IMPORTANT	1

SECTION A: GENERAL OR PERSONAL INFORMATION

1. POSITION OF RESPONDENT:

- a. Foreman d. Architect ☐ ☐
- b. Engineer e. Project or ☐ Construction Manager ☐
- c. Quantity Surveyor f. ☐ Managing Director ☐

g. Others; Specify:

.....

2. HIGHEST LEVEL OF EDUCATION:

- a. JHS e. HND ☐
- b. SHS f. Degree (BSc.) ☐
- c. Diploma g. Masters or ☐
- Postgraduate Diploma ☐
- d. Technician Certificate h. PhD ☐

i. Others; Specify:

.....

3. PLEASE INDICATE IF YOU ARE A MEMBER OF A PROFESSIONAL BODY:

- a. GhIE ☐
- b. GhIS ☐
- c. CIOB ☐
- d. GIA ☐
- e. GIOC ☐
- f. Others; Specify: ☐

.....

4. COMPANY CLASSIFICATION (FINANCIAL GRADE):

- a. A1 B1 ☐
- b. A2 B2 ☐
- c. A3 B3 ☐
- d. A4 B4 ☐

5. INDICATE SPECIAL ROADS AND TRANSPORT:

- a. Labour Only (C) ☐
- b. Steel Work (S) ☐

CLASSIFICATION WITH

6. NUMBER OF YEARS IN EXISTENCE AS A COMPANY:

- a. 1yr – 5yrs c. ☐ 11yrs – 20yrs ☐
- b. 6yrs – 10yrs d. ☐ 21yrs – 30 yrs ☐

- e. 31yrs – 40yrs
f. Above 40yrs (Kindly State):

SECTION B: LIST OF SOME FACTORS THAT ARE LIKELY TO INFLUENCE SAFETY PERFORMANCE

This list contains some factors that are likely to affect and influence the safety performance of road contractors. For each of these factors kindly select the appropriate answer by providing a tick [✓] under the appropriate scale provided. Please tick to indicate the level of importance you attach to each factor. *Please **tick** (✓) under the appropriate Scale.*

How Significant are the Following Factors in Influencing Safety Performance:	5	4	3	2	1
ORGANIZATIONAL LEVEL					
1. Development of safety policy					
2. Provision of safe working environment					
3. Number of informal safety inspections made by the company safety coordinator					
4. Length and detail of the company safety program					
5. More supportive upper management attitude towards safety					
6. Management talks on safety					
7. Growth in company size					
8. Reluctance to input resources to safety					
9. Organizational safety awareness & commitment					
10. Conduction of organizational policy review					
11. Implementation of safety audit to safety management systems					
12. Top management checks of safety records					
13. Employment of safety officers					
14. Employment of certified skilled labour					
15. Punishments for bad safety habits					
16. Incentives for good safety performance					
17. Minimizing worker turnover					
18. Implementation of safety management systems					
19. Development of safety committee					
PROJECT LEVEL					
20. Reduced project team turnover (team stability)					
21. Increase time devoted to safety for the project safety representative					
22. More formal meetings with supervisors and specialty contractors					

23. More informal safety meetings with supervisors					
24. Appointing a trained safety representative on site					
25. Meetings with the field safety representatives and craft workers					
26. Conducting site safety inspection and supervision					

How Significant are the Following Factors in Influencing Safety Performance:	5	4	3	2	1
27. Toolbox meetings					
28. Provision and Keeping of daily safety records and booklets					
29. Conducting accident investigation and analysis					
30. Identification of unsafe practices on site					
31. Identification of hazardous and dangerous activities					
32. Control of hazardous activities on site					
33. Excessive overtime work for labour					
34. Volume of a project					
35. New technologies in the execution of building projects					
36. Frequency of a foreman's presence in safety meeting					
37. Frequency of a foreman's announcing safety related matters to workers					
38. Frequency of a foreman's correcting workers' unsafe actions					
39. Frequency of a worker's partners reminding him of personal safety					
40. Frequency of a crew's receiving notices of hazard removal					
41. Frequency of a foreman's reminding new workers of safety regulations					
42. Poor safety awareness of project managers					
43. Development of emergency plan and procedures					
44. Disciplinary action for not conforming to safety practices					
SAFETY EDUCATION AND TRAINING					
45. Safety training for new foremen and safety coordinators					
46. Training with the assistance of contractor associations					
47. Hours of safety education per year a worker receives					
48. Days of safety education per year a safety officer receives					
49. Hours of safety education per year a foreman receives					
50. Lack of training					

51. Guidance and training of workers on safety					
52. Brochures and publications on safety					
53. Safety Posters and safety boards					
54. First aid training for all workers					
ECONOMIC FACTORS					
55. Enough money allocation for Company safety expenditures					
56. Increased budget allocation to safety awards					
57. Worker compensation insurance					
58. Safety investment on personal protective equipment					

How Significant are the Following Factors in Influencing Safety Performance:	5	4	3	2	1
59. Monetary incentives					
60. Non-monetary incentives					
61. Paying for the medical expenses of injured workers					
WELFARE FACILITIES					
62. Provision of safety clothing and equipment					
63. Provision of good shelter					
64. Provision of food and drinking water					
65. Provision of adequate facilities for first aid treatment					
66. Provision of special places for smoking					
67. Provision of adequate toilets					
MEDICAL FACILITIES					
68. Availability of medical service on site					
69. Periodic medical examination of workers					
ROLE OF GOVERNMENT & ENGINEERING SOCIETIES					
70. Supervision to ensure compliance with occupational safety legislation, codes and standards					
71. Issuing Laws, Standards, Regulations and Legislations on safety					
FIRE PREVENTION					
72. Availability of adequate fire extinguishers on site					
73. Good storage of flammable liquids and combustible materials					
74. Periodic maintenance of fire extinguishers on site					
TECHNICAL FACTORS					
75. Carrying out work in a safe manner					
76. Carrying out work in a professional manner					
77. Type and method of construction					

78. Provision of technical guidance					
79. Protection of materials in storage and transit					
80. Proper handling of tools, equipment and plant					
81. Maintenance of tools, equipment and plant					
82. Use of bad or poor equipment					
83. Availability of maintenance policy					
HISTORIC, HUMAN & PSYCHOLOGICAL FACTORS					
84. Worker age					
85. Worker experience					
86. Worker level of education					
87. Worker culture background					
88. Worker safety training received					
89. Worker safety awareness knowledge & involvement					
90. Worker accident's experience					
How Significant are the Following Factors in Influencing Safety Performance:	5	4	3	2	1
91. Worker ability to communicate with others					
92. Relation between worker and management on site					
93. Interrelation between workers on site					
94. Decrease work pressure on workers					
95. Relation between workers and foremen on site					
SECTION C: PROVISION FOR YOUR SPECIAL FACTORS AND COMMENTS					
OTHER IMPORTANT FACTORS (KINDLY PROVIDE)					

Kindly Provide information on additional sheets where necessary.

KNUST

APPENDIX C (Evaluation Questionnaire)

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF ARCHITECTURE AND PLANNING**

DEPARTMENT OF BUILDING TECHNOLOGY

EVALUATION QUESTIONNAIRE

This questionnaire is part of the research work for partial fulfillment of the award of MSc. in Construction Management on the topic “***SAFETY PERFORMANCE OF ROAD CONTRACTORS IN GHANA***”.

The overall purpose of this study is to empirically evaluate the safety performance of road construction companies in Ghana.

All responses will be kept ***strictly confidential*** and ***exclusively*** for academic use. Further information can be obtained from the researcher on telephone number 0242152219, or the supervisor, DR. E. ADINYIRA of KNUST (eadinyira.feds@knust.edu.gh). The researcher wishes you will consider his request and cooperate.

Please ***tick*** ☐ where appropriate.

RATING SCALE DEFINITIONS

No	Not in place
Yes	In Place
1	In place but limited or little/no documentation
2	In place, including documentation, no audit or review

- 3 In Place, proven performance, up to date documentation, periodic audits

WORKFORCE STATISTICS (for Last 3 years)

VARIABLE	2012	2013	2014
Average Number of Employees			
Employee Exposure Hours			
Number of Fatalities			
Number of Lost Workday Cases			

S/N	A. MANAGEMENT COMMITMENT	No	Yes	1	2	3
1	Does your organization have a written Safety Policy?					
2	Does your organization have a Safety Program?					
3	Does your organization set annual safety goals?					
4	Are management and supervisors actively involved in your Safety program?					
5	Does the organization conduct workforce safety meetings?					
6	Do management and/or supervisors periodically participate in safety meetings with employees?					
7	Does supervision conduct unscheduled/informal safety meetings for field workers?					
8	Does your management hold periodic meetings with the owner's management, specifically to discuss safety and job performance?					
9	Does management conduct periodic organizational policy review?					
10	Is management committed to ensuring safety on site?					
11	Does your organization have a program in place for recognition of excellent safety performance by individuals?					
12	Does your organization have a program in place for progressive discipline for unacceptable safety performance?					
13	Does your organization have company-specific safety rules?					
14	Does top management check safety records of your organization?					

15	Does your organization have a safety officer?					
16	Does your safety representative have sufficient authority to correct hazards?					
17	Does management implement measures to prevent or reduce worker Turnover?					
18	Does management provide resources for implementation of safety practices?					
19	Does management always provide Personal Protective Equipment (PPE)?					
20	Does management makes enough budgetary allocation for the company's safety expenditures?					
21	Do you use sub-contractors?					
22	Is there a program in place for evaluating the safety performance of sub-contractors prior to hire?					
23	Are pre-job safety conferences conducted with your subcontractors?					
	AVERAGE SCORE - MANAGEMENT COMMITMENT					
S/N	B. SAFETY RESPONSIBILITY	No	Yes	1	2	3
24	Do job descriptions for your supervisors and management personnel include Safety responsibilities?					
25	Are individuals with Safety responsibilities clearly identified within your organization?					
26	Does it include individuals dedicated full time to safety? If so, are they professionally certified?					
27	Do you provide adequate safety posters and boards on site?					
28	Does your organization have printed brochures and publications on safety?					
29	Do you have measures in place for introducing workers to new technologies in the execution of projects with regards to safety?					
30	Do you provide Toolbox meetings to your workforce?					
31	Does management carry out supervision to ensure that projects are carried out in compliance with occupational safety legislations and standards?					
	AVERAGE SCORE - SAFETY RESPONSIBILITY					

S/N	C. SAFETY PROGRAMS & WORK PRACTICES	No	Yes	1	2	3
	Does the organization have a written program for:					
32	➤ Emergency Action Plan					

33	➤ Personal Protective Equipment (e.g. hard hats, safety glasses, respirators, etc.)					
34	➤ Fall Protection including Scaffolding					
35	➤ Confined Space Entry					
36	➤ Hearing Conservation					
37	➤ Electrical Safety					
38	➤ Respiratory Protection					
39	➤ Excavation/Shoring					
40	➤ Lifting/Mobile Equipment					
41	Does the contractor conduct audits to verify that all work permit systems are followed and its disciplinary action implemented in the event of noncompliance?					
	AVERAGE SCORE – SAFE WORK PRACTICES					

S/N	D. SAFETY EDUCATION AND TRAINING	No	Yes	1	2	3
42	Do you have indoctrination for new employees?					
43	Is there a process in place for monitoring newly assigned workers, for example, a buddy system?					
44	Do you have additional Safety training for foremen, supervisors and managers?					
	On which of the following subjects do you provide training and ensure verification of understanding as required by their job task or by the applicable government regulation:					
45	➤ Use and Care of Respirators					
46	➤ Use and Care of Hearing Protection					
47	➤ Confined Space Entry					
48	➤ Fall Protection including Scaffolding Competent Person and Users, ladders & stairways, walking & working surfaces, and aerial lifts.					
49	➤ Industrial Trucks (Fork lifts, aerial lifts, etc.)					
50	➤ Heavy equipment operators, riggers and signal persons (Crane, excavators, etc.)					
51	➤ Material safety data sheets and hazard communication program					
52	➤ Fire watch					

53	➤ Electrical safe work practices (Qualified & Unqualified persons)					
54	➤ Use of Fire Extinguisher					
55	➤ m. Transportation of Hazardous Materials					
56	➤ Use and Care of Personal Protective Equipment (Personal owned and employer provided)					
57	➤ Excavating shoring & trenches (competent person training)					
58	➤ Emergency Response Plan					
59	Do you provide education to your workers on safety posters and boards?					
60	Do you provide first aid training for all workers?					
	AVERAGE SCORE – HEALTH & SAFETY TRAINING					

S/N	E. JOB TRAINING & QUALIFICATION	No	Yes	1	2	3
61	Are all the contractors' employees trained in the appropriate job skills and work practices necessary to perform their job safely?					
62	Is there documentation in place that each employee has received and understands the required training?					
63	Do you have a process to assess the skills of your workers to assure they are qualified? If so, what assessment process are you using: National Vocational Skills (NVTI) _____ Own _____ Other _____					
64	Are employees enrolled in skill upgrade training based on results of craft skill assessment?					
65	Are employees job skills certified where required by regulatory or industry consensus standards?					
66	Is there a program in place for certifying or qualifying crane operators and riggers?					
67	Is training for personnel involved in operating a process equivalent to that provided to owner direct hire employees?					
68	Is documentation available to verify understanding?					
69	Is refresher training provided at least every 3 years?					
70	Is the facility owner expected to assist with training?					

	AVERAGE SCORE – JOB TRAINING & QUALIFICATION					
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S/N	F. INCIDENT REPORTING & INVESTIGATION	No	Yes	1	2	3
71	Does your organization have a process in place for immediate reporting and investigation of accidents and near misses?					
72	Does the process include immediate notification of the owner of all incidents including first aid cases?					
73	Does the process include root cause analysis?					
74	Do supervisors or managers ensure that, as a result of the investigation, corrective action is taken, tracked, and completed?					
75	Communication process to all employees on results of investigation and corrective action taken?					
	AVERAGE SCORE - INCIDENT REPORTING & INVESTIGATION					
S/N	G. INSPECTIONS & HAZARD IDENTIFICATION	No	Yes	1	2	3
76	Are pre-task safety assessments conducted by the crew performing the task?					
77	Do supervisors and managers periodically perform Safety inspections of the work-site? At what frequency?					
	Do inspections include at least the following topics:					
78	➤ Housekeeping					
79	➤ Proper Use of Personal Protective Equipment					
80	➤ Compliance with company and client & procedures and government regulations					
81	➤ Condition of and correct use of tools and equipment					
82	Have you had an Organizational Safety inspection in the last three years?					
83	Are safety inspections records kept on file and are they available for review by the owner?					
84	Do you have any employee safety suggestion program?					
85	Are employee suggestions encouraged and acted upon?					
86	Do you have a program in place for employee recognition and reporting of work place hazards that encourages employee to intervene when unsafe conditions or actions are observed?					
87	Have the Safety hazards associated with the type of work and services you provide been identified?					

88	Has a risk assessment been performed on these hazards?					
89	Has the facility owner been informed of these hazards?					
90	Does the program include a follow-up system to ensure that all reported incidents and conditions are corrected in a timely manner?					
	AVERAGE SCORE - INSPECTIONS & HAZARD IDENTIFICATION					

S/N	H. MEDICAL/ WELFARE FACILITIES	No	Yes	1	2	3
91	Do you have a process in place to provide emergency medical/first aid?					
92	Is first aid provided on site?					
93	Are adequate first aid supplies available on site?					
94	Do you have adequate Personal Protective Equipment (PPE) on site?					
95	Do you provide workers with good shelter?					
96	Do you provide your workforce with food and good drinking water?					
97	Are workers provided with adequate facilities for washing, cleaning, drying, smoking, toilets, smoking etc.?					
	AVERAGE SCORE – MEDICAL MONITORING PRACTICES					

S/N	I. TECHNICAL FACTORS	No	Yes	1	2	3
98	Do you have regulations in place to ensure that works are carried out in a safe manner?					
99	Do you have regulations in place to ensure that workers perform their tasks professionally?					
100	Does your organization have a written maintenance policy covering the maintenance of facilities, tools, equipment, plant etc.?					
101	Do you conduct training for workers on the proper handling of tools, equipment and plant?					
102	Do you discourage the use of poor or bad performing equipment or plant?					
103	Do you always insist on the availability of firefighting equipment on site?					

104	Do you have adequate fire extinguishers on site?					
105	Do you conduct periodic servicing or maintenance of firefighting equipment?					
106	Does your organization have regulations or policies governing the storage of flammable liquids and other combustible materials?					
	AVERAGE SCORE - TECHNICAL FACTORS					

S/N	COMMENTS	No	Yes	1	2	3

S/N	SCORE SHEET	SCORE
A	MANAGEMENT COMMITMENT	
B	SAFETY RESPONSIBILITY	
C	SAFETY PROGRAMS & WORK PRACTICES	
D	SAFETY EDUCATION AND TRAINING	
E	JOB TRAINING & QUALIFICATION	
F	INCIDENT REPORTING & INVESTIGATION	
G	INSPECTION & HAZARD IDENTIFICATION	
H	MEDICAL AND WELFARE FACILITIES	
I	TECHNICAL FACTORS	
	TOTAL SCORE	
	AVERAGE SCORE	